TECHNICAL UNIVERSITY OF OSTRAVA

FACULTY OF ECONOMICS

DEPARTMENT OF FINANCE

Optimalizace Složení Mezinárodního Portfolia Akcií

Optimal Composition of International Equity Portfolio

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I herby affirm that I have independently elaborated the whole work including all annexes.

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1. INTRODUCTION

Almost everyone has the portfolio; the portfolio may include physical assets such as cars, real estate, refrigerators, etc. and financial assets such as stocks, bonds, etc. or their combination. Investors always analyze and make decision about composition of the optimal portfolio that ensures him certain level of profit at a given level of risk.

The objective of the diploma thesis is to find optimal composition of portfolio containing equity only. For solution of this problem CAMP model and Markowitz model will be applied to find the efficient set and then show the finding of the optimal portfolio composition.

The diploma thesis is divided into three main parts. In the first part it will be described the investment decision-making and financial institutions. Moreover, attention will be paid to the investment analysis like risk, investment psychology, etc. Next, financial markets will be described – how the financial system works, partial markets (money markets and capital markets), and main financial instruments of these markets (funds, stocks, bonds, etc). Last part of the chapter is dedicated to the description of the financial markets participant's, i.e. financial institutions.

In the second part, methodology of portfolio choice is described and explained including fundamentals of portfolio management. Attention will be paid primarily to the assumptions and theory of Markowitz portfolio selection. Furthermore, principles, assumption and application of the capital asset pricing model and the security market line will be described here including main variables for efficient portfolio selection - risk and return. Last part will be focused on the financial statements analysis, such as corporate valuation and investment ratios.

Third part is the application and the most important part of the diploma thesis. The first part is focused on the CAPM application, the second one on the efficient set selection. In the case of the CAPM application, first the description of the input data is made. Next, the CAPM model is applied for the valuation purposes. In the case efficient composition selection, Markowitz model will be employed to get portfolio composition. First, the description of the

input data and the function of Markowitz model is made. Afterwards the procedure of efficient composition is described. In the end, optimal equity portfolio composition will be found.

2. INVESTMENT DECISION-MAKING OF FINANCIAL INSTITUTION

In the chapter 2, it will divide three parts to show a investment decision-making of financial institution. The first part is investment analysis; there are theoretical investment decision rules and investment psychology. The second part is financial markets. About financial markets, it shows the financial system and money markets and capital markets. The third part describes financial institutions types.

2.1 Investment Analysis

Investment is an asset or item that is purchased with the hope that it will generate income or appreciate in the future. In an economic sense, an investment is the purchase of goods that are not consumed today but are used in the future to create wealth. In finance, an investment is a monetary asset purchased with the idea that the asset will provide income in the future or appreciate and be sold at a higher price.

The examples of investments in the economic are the building of a factory used to produce goods and the investment one makes by going to college or university. Be sure not to get “making an investment” and “speculating” confused. Investing usually involves the creation of wealth whereas speculating is often a zero-sum game; wealth is not created. Although speculators are often making informed decisions, speculation cannot usually be categorized as traditional investing.

2.1.1 Investment Decision Rules

Investment process consists of four steps that result in an initial investment strategy and portfolio allocation. Yearly consultations with portfolio manager ensure that investment strategy remains on track to meet goals even as market conditions and financial needs change over time.

Of course it always have access directly to portfolio manager if they require guidance or if situation changes between consultations and it never locked into any investment, so if it needs to liquidate an investment to meet a sudden financial need, it can do so.

There are four steps for investment process. There are (1) understanding the specific

situation; (2) Formulating an investment strategy; (3) Implementing the investment strategy; (4) Monitoring the portfolio. Now, it is going to describe it one by one.

（1） Understanding the specific situation

Gather information on resources, investment goals and constraints, and nonfinancial as well as financial objectives sets the stage for an appropriate investment strategy. This information is used to derive an understanding of investment time horizon, the knowledge and comfort level with respect to various investment products, and tolerance to risk as it relates to expected portfolio return.

（2） Formulating an investment strategy

By understanding the specific situation, and through in-depth knowledge of investment strategies and produces, portfolio manager ensures that the selected strategy will be customized to needs and thoroughly discusses and explains the investment strategy and products that recommend Investment Policy Statement.

Each year, portfolio manager will review financial plan with client to determine whether changes are required, perhaps because of changing market conditions or changes in the investment goals.

（3） Implementing the investment strategy

Investment policy statement will indicate a preferred asset allocation and constraints on certain types of investment products and strategies. In step three, portfolio manager will use this guidance to allocate portfolio appropriately amongst individual holdings.

From time to time, portfolio manager may make changes to these holdings as market conditions warrant, but any changes will always be in keeping with the strategy that was agreed to in investment policy statement.

（4） Monitoring the portfolio

Ongoing monitoring of investments by a portfolio manager ensures that there is always a knowledgeable professional looking after best interests. Periodic changes are needed as the

prospects for individual holdings change with time and market conditions.

It is equally important to understand how portfolio is performing both with respect to expectations and in comparison to appropriate benchmarks. Portfolio manager provides quarterly updates on investments and a yearly in-depth portfolio review.

In the yearly review, portfolio manager will present a comparison between the performance of investments and a benchmark which was pre-selected in investment policy statement. This comparison clearly shows how much value portfolio management has added over the year and how that value was added. In addition, portfolio manager must compare yearly results with long-term return expectations to determine if remain on track to meet investment goals or if changes in strategy are required.

2.1.2 Investment Psychology

How Portfolio Management Works

There are two types of stock-pickers:

(1) Investors who focus on fundamental analysis and seek to determine the intrinsic value of a stock. They believe that, sooner or later, market value will approach intrinsic value.

These investors believe that all other price changes are temporary phenomena. Intrinsic value is what financial analysts seek to measure. A fundamental investor seeks to invest over the medium or long term and like Warren Buffet, who is the most famous of them all, wait patiently for the market value to converge towards the intrinsic value.

(2) Investors who focus on technical analysis, the so-called chartists, who do not seek to determine the value of a stock. Instead, these investors conduct detailed studies of trends in a stock's market value and transaction volumes in the hope of spotting short-term trends.

Chartists prefer to analyze how the market perceives intrinsic value rather than looking at the stock's actual intrinsic value.

Chartists believe the market is predictable in the very short term, and this is often the attitude of traders and banks who take positions for very short periods, from a few hours to a

few days.

Technical analysis is not based directly on any theory. It is based more on psychology than mathematics. Chartists believe that, while investors are not perfectly rational, they at least are fixed in their way of reasoning, with predictable reactions to certain situations. Chartists look for these patterns of behavior in price trends.

One method consists in calculating a moving average of prices over a certain number of days (generally 20). Chartists look for a price to break through its moving average, either upward or downward.

Another method is based on comparing a stock's prices with its highs and lows over a given period. This is used in identifying support and resistance levels:

(1) A support is a level that the price has very little chance of falling below;

(2) A resistance is a level that the price has very little chance of rising above.

Some fundamental investors seek out growth stocks (companies in sectors offering sustainable growth), while others seek out value stocks (companies in more mature sectors that provide long-term performance). At the end of the spectrum, investors choose income stocks whose prices are relatively stable and provide the bulk of their returns from dividends. Asset managers have developed several types of funds targeted specifically at these types of investors: growth funds, value funds and mixed funds. These last, mixed funds are actually a combination o the first two.

Another type of fund management has arisen recently, so called alternative management, which is based on market declines, volatility, liquidity, time value and abnormal valuations, rather than on rising prices. An example of alternative management is the hedge fund, which is a speculative fund seeking high returns and relying heavily on derivatives, and options in particular. Hedge funds use leverage and commit capital in excess of their equity. Hedge funds offer additional diversification to "conventional" portfolios, as their results are in theory not linked to the performances of equity and bond markets.

Risk Attitudes

Behavior of the investors can influence the market only for the short time. Psychological factors do not influence long trends in the market. Psychological analysis is based on the presumption that behavior of the investors is very important price creator – especially during very short periods. The influence of investor to making decision is risk attitudes. According the investor's risk attitudes, can collection of three types, there are the risk aversion, the risk lover and the risk neutral.

A risk-averse investor dislikes risk, and therefore will stay away from adding high-risk stocks or investments to their portfolio and in turn will often lose out on higher rates of return. Investors looking for "safer" investments will generally stick to index funds and government bonds, which generally have lower returns.

About the risk lover, there is always a risk/return tradeoff in investing. Lower returns are usually associated with lower risk investments. Higher potential returns are associated with investments of higher risk, as most investors expect to be compensated for taking on additional risk. Risk lovers, however, go against this principle: they acquire investments of higher risk with a lower expected return.

A risk neutral investor is only concerned with an investment's expected return. risk neutral investor able to choose any combination of an array of risky assets (various companies' stocks, various companies' bonds, etc.) would invest exclusively in the asset with the highest expected yield, ignoring its risk features relative to those of other assets, and would even sell short the asset with the lowest expected yield as much as is permitted in order to invest the proceeds in the highest expected-yield asset. In contrast, risk aversion investor would diversify among a variety of assets, taking account of their risk features, even though doing so would lower the expected return on the overall portfolio. The risk neutral investor's portfolio would have a higher expected return, but also a greater variance of possible returns.

2.1.3 The Risk of Securities and The Cost of Capital

Investors who buy financial securities face risks because they do not know with certainty the future selling price of their securities, nor the cash flows they will receive in the meantime.

There are various risks involved in financial securities, including industrial, commercial and labor risks, liquidity risk, solvency risk, currency risk, interest rate risk, political risk, regulatory risk, inflation risk, the risk of fraud, natural disaster risks, and economic risk.

(1) Industrial, commercial and labor risks, etc.

They include: lack of competitiveness, emergence of new competitors, technological breakthroughs, an inadequate sales network, strikes and others. These risks tend to lower cash flow expectations and thus have an immediate impact on the value of the stock.

(2) Liquidity risk

This is the risk of not being able to sell a security at its fair value, as a result either of a liquidity discount or the complete absence of a market or buyers.

(3) Solvency risk

This is the risk that a creditor will lose it's entire investment if a debtor cannot repay him in full, even if the debtor's assets are liquidated. Traders also call this counterparty risk.

(4) Currency risk

Fluctuations in exchange rates can lead to a loss of value of assets denominated in foreign currencies. Similarly, higher exchange rates can increase the value of debt denominated in foreign currencies when translated into the company's reporting currency base.

(5) Interest rate risk

The holder of financial securities is exposed to the risk of interest rate fluctuations. Even if the issuer fulfils his commitments entirely, there is still the risk of a capital loss or, at

the very least, an opportunity loss.

(6) Political risk

This includes risks created by a particular political situation or decisions by political authorities, such as nationalization without sufficient compensation, revolution, exclusion from certain markets, discriminatory tax policies, inability to repatriate capital, etc.

(7) Regulatory risk

A change in the law or in regulations can directly affect the return expected in a particular sector. Pharmaceuticals, banks and insurance companies, among others, tend to be on the frontlines here.

(8) Inflation risk

This is the risk that the investor will recover investment with a depreciated currency.

(9) The risk of fraud

This is the risk that some parties to an investment will lie or cheat.

(10) Natural disaster risks

They include storms, earthquakes, volcanic eruptions, cyclones, tidal waves, etc., which destroy assets.

(11) Economic risk

This type of risk is characterized by bull or bear markets, anticipation of acceleration or a slowdown in business activity or changes in labor productivity.

Obviously, any serious investment should begin with a precise analysis of the risks involved.

The knowledge gleaned from analysts with extensive experience in the business, mixed with common sense, classify risks into two categories:

(1) Economic risks (political, natural, inflation, swindle and other risks), which threaten cash flows from investments and which come from the “real economy”.

(2) Financial risks (liquidity, currency, interest rate and other risks), which do not directly

affect cash flow, but nonetheless do come under the financial sphere. These risks are due to external financial events, and not to the nature of the issuer.

2.2 Financial Markets

Financial markets can be found in nearly every nation in the world. Some are very small, with only a few participants, while others – like the New York Stock Exchange (NYSE) and the foreign exchange markets – trade trillions of dollars daily. Most financial markets have periods of heavy trading and demand for securities; in these periods, prices may rise above historical norms. The converse is also true – downturns may cause prices to fall past levels of intrinsic value, based on low levels of demand or other macroeconomic forces like tax rates, national production or employment levels. Information transparency is important to increase the confidence of participants and therefore foster an efficient financial marketplace.

2.2.1 Financial System

There are multiple components making up the financial system of different levels: Within a firm, the financial system encompasses all aspects of finances. For example, it would include accounting measures, revenue and expense schedules, wages and balance sheet verification. Regional financial systems would include banks and other financial institutions, financial markets, financial services in a global view, financial systems would include the International Monetary Fund, central banks, World Bank and major banks that practice overseas lending.

Classification of Financial Markets

It will according the character of market to compare it, the character are by nature, maturity, seasoning and immediate or future delivery.

(1) By Nature of claim: Debt Market vs. Equity Market

Debt market is the market with the debt securities, debt securities have maturities ranging from one day to twenty years or longer, investors who purchase these securities are creditors. Equity securities typically have no maturity, represent ownership in a business; investors who purchase these securities are owners.

(2) By maturity of claim: Money Market vs. Capital Market

Money market is the market for financial instruments a year or less to maturity, in money markets short-term debt instruments are issued by economic units that require short-term funds and are purchased by economic units that have excess short-term funds. Capital market is the financial market for equity and debt instruments with a maturity greater that one year. Capital market securities are expected to generate a higher annualized return to investors.

(3) By seasoning of claim: Primary Market vs. Secondary Market

Primary market is the market for the new securities which are in this market issued. Primary market transactions provide funds to the initial issuer of securities. Secondary market is the market in which existing securities are resold.

(4) By immediate or future delivery: Cash Market (or Spot Market) vs. Derivative Market

Cash market is the market in which a financial asset trades for immediate delivery. Derivative market is the market in which derivative securities trade and the value of these instruments derived from the underlying assets. The delivery of derivative securities is in future.

2.2.2 Money Markets

The money market is a subsection of the fixed income market. In reality, a bond is just one type of fixed income security. The difference between the money market and the bond market is that the money market specializes in very short-term debt securities (debt that matures in less than one year). Money market investments are also called cash investments because of their short maturities.

Money market securities are essentially IOUs issued by governments, financial institutions and large corporations. These instruments are very liquid and considered extraordinarily safe. Because they are extremely conservative, money market securities offer significantly lower returns than most other securities.

One of the main differences between the money market and the stock market is that most money market securities trade in very high denominations. This limits access for the individual investor. Furthermore, the money market is a dealer, which means that firms buy and sell securities in their own accounts, at their own risk. Compare this to the stock market where a broker receives commission to acts as an agent, while the investor takes the risk of holding the stock. Another characteristic of a dealer market is the lack of a central trading floor or exchange. Deals are transacted over the phone or through electronic systems.

The easiest way for there to gain access to the money market is with money market mutual funds, or sometimes through a money market bank account. These accounts and funds pool together the assets of thousands of investors in order to buy the money market securities on their behalf. However, some money market instruments, like Treasury bills, may be purchased directly. Failing that, they can be acquired through other large financial institutions with direct access to these markets.

There are several different instruments in the money market, offering different returns and different risks.

Treasury Bills (T-Bills)

Treasury Bills (T-bills) are the most marketable money market security. Their popularity is mainly due to their simplicity. Essentially, T-bills are a way for the U.S. government to raise money from the public. In this tutorial, they are referring to T-bills issued by the U.S. government, but many other governments issue T-bills in a similar fashion.

T-bills are short-term securities that mature in one year or less from their issue date. They are issued with three-month, six-month and one-year maturities. T-bills are purchased for a price that is less than their par (face) value; when they mature, the government pays the holder the full par value. Effectively, the interest is the difference between the purchase price of the security and what will get at maturity.

Treasury bills are issued through a competitive bidding process at auctions. If someone wants to buy T-bill, it submits a bid that is prepared either non-competitively or competitively. In non-competitive bidding, it'll receive the full amount of the security that wants at the return

determined at the auction. With competitive bidding, it has to specify the return that would like to receive. If the return specify is too high, it might not receive any securities, or just a portion of what bid for.

The biggest reason that T-Bills are so popular is that they are one of the few money market instruments that are affordable to the individual investors. T-bills are usually issued in denominations of $1,000, $5,000, $10,000, $25,000, $50,000, $100,000 and $1 million. Other positives are that T-bills (and all Treasuries) are considered to be the safest investments in the world because the U.S. government backs them. In fact, they are considered risk-free. Furthermore, they are exempt from state and local taxes.

Certificate Of Deposit (CD)

A certificate of deposit (CD) is a time deposit with a bank. CDs are generally issued by commercial banks but they can be bought through brokerages. They bear a specific maturity date (from three months to five years), a specified interest rate, and can be issued in any denomination, much like bonds. Like all time deposits, the funds may not be withdrawn on demand like those in a checking account.

It is large-dollar-amount short-term certificate of deposits. Such certificates are issued by large banks and bought mainly by corporations and institutional investors. Although they can be issued in any denomination from 100000 dollars, the typical amount is 1000000 dollars.

Commercial Paper

For many corporations, borrowing short-term money from banks is often a laborious and annoying task. The desire to avoid banks as much as possible has led to the widespread popularity of commercial paper.

Commercial paper is an unsecured, short-term loan issued by a corporation, typically for financing accounts receivable and inventories. It is usually issued at a discount, reflecting current market interest rates. Maturities on commercial paper are usually no longer than nine months, with maturities of between one and two months being the average. For the most part, commercial paper is a very safe investment because the financial situation of a company can

easily be predicted over a few months. Furthermore, typically only companies with high credit ratings and credit worthiness issue commercial paper. Over the past 40 years, there have only been a handful of cases where corporations have defaulted on their commercial paper repayment. Commercial paper is usually issued in denominations of $100,000 or more. Therefore, smaller investors can only invest in commercial paper indirectly through money market funds.

Bankers' Acceptances

A draft or bill of exchange accepted by a bank to guarantee payment of the bill. It is commonly used for international trade transactions. Exporters often prefer that banks as guarantor before sending goods to importers whose credit is not known. Exporting firms can sell the acceptances at a discount to obtain funds.

Eurodollars

Contrary to the name, Eurodollars have very little to do with the euro or European countries. Eurodollars are U.S.-dollar denominated deposits at banks outside of the United States. This market evolved in Europe (specifically London), hence the name, but Eurodollars can be held anywhere outside the United States.

The Eurodollar market is relatively free of regulation; therefore, banks can operate on narrower margins than their counterparts in the United States. As a result, the Eurodollar market has expanded largely as a way of circumventing regulatory costs. The average Eurodollar deposit is very large (in the millions) and has a maturity of less than six months.

Repos

Repo is short for repurchase agreement. Those who deal in government securities use repos as a form of overnight borrowing. A dealer or other holder of government securities (usually T-bills) sells the securities to a lender and agrees to repurchase them at an agreed future date at an agreed price. They are usually very short-term, from overnight to 30 days or more. This short-term maturity and government backing means repos provide lenders with extremely low risk. Repos are popular because they can virtually eliminate credit problems. Unfortunately, a number of significant losses over the years from fraudulent dealers suggest

that lenders in this market have not always checked their collateralization closely enough. There are also variations on standard repos:

(1) Reverse Repo - The reverse repo is the complete opposite of a repo. In this case, a dealer buys government securities from an investor and then sells them back at a later date for a higher price

(2) Term Repo - exactly the same as a repo except the term of the loan is greater than 30 days.

2.2.3 Capital Markets

By having the role of facilitating the flow of long-term funds, the capital market is the market for long-term loans and equity capital. It is the financial market for equity and debt instruments with a maturity greater than one year. Companies, municipalities and the government can raise funds for long-term investments via capital market.

Capital market includes stock market and bond market. Degrees of liquidity of the instruments of these markets vary with the type of the instrument, maturity of the instrument and its secondary market activity. Liquidity provides the investor an opportunity to reverse his trade. Without the ability to sell financial assets investors would be reluctant to purchase them.

Stock Markets: Spot Market and Futures Market (and Forward Market)

The stock market is divided into two categories: the spot market and futures market.

(1) Spot Market

Spot market is that investors pay for financial assets or physical assets currency trading market. Articles of Association are a company owned entity, the articles of association rights and obligations of shareholders. Shareholders are the company owners, so has all the physical assets. Common stock is on behalf of the company property. Each stock on behalf of shareholders to amend the company charter or articles of association and other decisions required a vote, also said that a certain proportion of corporate value.

How the company set up the articles of association. As company owners, shareholders

of the company management have the final control. The Board represents the interests of shareholders to monitor senior management. Senior management is divided into two departments, one for financial management, a non-financial management. Financial Management is responsible for corporate finance, such as dividend expense, capital budgeting, project finance, equity issuance and financial reporting. Non-financial management is physical asset management, such as products, operations and marketing. A company can claim to have a portfolio of companies. In the control and profit distribution, economic relations are between parent and subsidiary companies similar to the relationship between headquarters and business.

Ownership of the shareholders for profit, there are usually two ways: dividends and capital gains. Dividend payment or allotment may take the form of cash. Typically, if the dividend is announcement then the company will distribute dividends quarterly. The company is not obligation to pay dividends, the company is not necessary to pay dividends.

In particular, the shareholders expect growth through capital gains or shares held by hungry stock obtained from the main income. Most of the stock can trade, buyers and sellers is to price negotiation exchange, the seller and the difference between the original prices as capital gains (losses). Since buyers do not know when the first shot to buy stocks when the prices, so has the risk of stock returns at this time. Transactions are between owners through the full realization of price appreciation and the stock ownership change is an important part of the company owners.

Transactions not only two people between the buyer and seller. Most transactions are for network, composed of the securities market. There are two main types of securities markets: the primary market and secondary markets. A market is to solve the initial issue of securities. The early establishment of the company, the shares sold to the initial investors, trading in the primary market. Investment banks often act as brokers, to determine the subscription price of the stock, to provide investors buy shares.

Actual location of the Stock Exchange, shares were trading at this trading is the trading price when the price. New York Stock Exchange trading system using the expert. Each stock is assigned to a specialist or a professional company. In the transaction process, the expert

responsible is for maintaining orderly price movements, to ensure that the stock does not soar or plunge and stock liquidity. At any time, unless the suspension, the experts will present the purchase price and the seller, experts in the selling price of the purchase price to buy or sell stocks. Clearly, the total selling price should be higher than the purchase price. Otherwise, the experts will come to buy from sell. Experts do not prefer to buy a price higher than the offer price. Everyone is like buy low, sell high.

When investors buy orders when the market price, the transaction price shall prevail Ask an expert. Conversely, if investors sell, the transaction price of the purchase price will be the expert. Therefore, investors willing to buy a higher selling price, the lower the purchase price to sell. In the two-way trade, instantaneous transactions, investors are selling price and the cost of the purchase price difference, known as the bid-ask spread.

Neither the OTC market trading centers no experts to maintain stock trading. Dealers or market makers are for office anywhere in the world to provide investors with transactions. Quote of the competition to promote the trading price and the trading prices of fairness and rationality. Order to compete; market maker reported preferential trading prices, bid-ask spread in the process is fixed in the competitive equilibrium level. NASDAQ OTC market system is part. Efficient trading through the stock market is to produce a continuous stock price, a real-time quote. Does not represent real-time quotes price is at any given moment. But it may at any time trading prices for most stocks; the decision by the competition. General practice is that whenever regarded as the average stock price quotations. Market the end of the closing price of development, that transactions of the last trading price. The continuous price is as the market prices of listed companies.

(2) Futures and Forward Market

Futures contract is a contract between buyer and seller. The basis of negotiations and contract is expiration date of the asset price. Agreement at the beginning, there was no exchange of money and in kind. The date of termination, the contract price the buyer will buy the underlying asset.

Futures contracts and forward market is basically the same, but the futures exchanges,

and the mark to market every day. Futures contracts are in the end of each transaction to generate new price. If prices rise, the seller will pay buyers the difference; but how to reduce the price, the buyer will pay the seller the difference between the securities market price. Futures price generated by the futures market, and served as an intermediary between buyer and seller roles.

For the stock market, futures contracts underlying transactional some indicators, such as the S & P500 index, the Nikkei 225 stock average and the FT-SE 100 index. Index futures contract is to provide the date of termination, the termination date, and the futures price is a given value, not the actual delivery. In general, the futures price represents the market index futures expiration time of the expected value.

While the futures market and forward market, the only difference is marked to market, and led to the withdrawal or cash deposit account loans, but interest rate risk will lead to different futures and forward pricing. If you ignore the interest rate risk, futures and forward prices should be the same. Because most of the time a futures contract is relatively short, period of less than a year, so you can accept this hypothesis. Therefore, futures prices often consistent with the forward contract price. If the stock price is S, futures or forward price is F, then the risk-free rate of return than some discounted dividend yield must equal the net value of F S. Alternatively, the forward price is the long-term stock price risk-free rate of return than the dividend yield rate. The following formula is the dividend yield is equal to 0, the market no arbitrage condition

$$F = S(1+ r_f)^T \qquad (2.1)$$

$S(1+ r_f)^T$ is higher than the forward price assumptions, engaging in arbitrage is to sell forward contracts, to borrow the cash (risk-free rate of return in the r_f, is equal to S), to buy shares. Engaged in arbitrage thrown in the stock exchange is to get benefits equal to the forward price. Repay the loan, the rest is their profit. Since there is no risk of the profits, income security, the process is called arbitrage.

Similarly, the forward price is lower than $S(1+ r_f)^T$, the person will engage in arbitrage

buying forward contracts. At the same time, he will short the stock and risk-free interest income to invest. The date of delivery, the forward price investor is to buy stocks, and then repay the stock to fill vacancies in positions. Investment and risk-free rate of return is the difference between the forward price arbitrage profits. Based on the above formula, the arbitrage mechanism will continue to run until the forward price and the stock price the same.

Perfect Capital Markets

Usually, stocks, Treasury bills and swaps markets and other securities transactions, compared with the smallest market frictions. Market participants have access to market information, and to convey to the market supply and demand curves. Transaction is the price-making process, allowing the market have perfect market prices, supply and demand peace. In contrast, the trading office has more friction, including the collection of information. Resulting prices may not reflect the business of building supply and demand. This model is called a perfect capital market model. This model is ideal envisioned the capital market, the market is that many sellers and buyers of securities trading places, the perfect capital market is in an ideal environment for buyers and sellers under the trading securities, especially with what characteristics. There are (1) all securities fully separable; (2) no transaction costs; (3) no tax; (4) market is perfectly competitive; (5) no short selling restrictions; (6) information is symmetric; (7) investors are rational, the utility of wealth increases the marginal utility of wealth (risk aversion) to reduce.

(1) All securities fully separable

Can buy or sell securities of any non-integer, for buyers and sellers want to trade is no minimum limit. From the model point of view, this is a technical problem. Without this assumption, it will have to carefully consider the transaction size. This simple assumption can be slightly affected the model results, but will not change the basic factors affect the equilibrium price.

(2) No transaction costs

Transaction costs include brokerage fees, asset management fees, and transaction fees and bid-ask spread communication, through various methods of model results and market

theory. For example, if no transaction costs, the economy would not have the financial intermediation sector, such as banks and insurance companies. First, if no transaction costs, why should the establishment of an economy of financial intermediation? Make this assumption only to understand and analyze the transaction costs, is due to investment theory and not really related to the role of banks and other institutions, will not affect how the investment. Guide for investment theory portfolio also understand the pricing of the portfolio of securities.

(3) No tax

In the financial field, such the assumption that the tax is not exaggerated. Clearly, it has to pay taxes, and taxes will affect the investment. This simple assumption is let people first understand the way tax-free, and then how the improved model to analyze the tax impact of model results.

(4) Market is perfectly competitive

A single buyer or seller can influence market prices, because in fact there are many buyers and sellers. The assumption is essential. Suppose there is a strong financial institution shares the fairness of the decision, then the investment theory is not the same. It is expected that this strong institutions are more concerned about the decision, with little focus on asset transactions, the role of markets and price-setting process. Market is perfectly competitive; the assumption is realistic and very important.

(5) No short selling restrictions

Short selling is the sale of securities is not his own. In general, investors in securities it believes prices will fall after a certain time to sell. The mechanism of short selling can be described; investors borrow securities and promised to return at some future point in time the lender. Then, investors sell securities in the open market. Over time, if the stock prices fall, investors can buy securities and the return to the original lender. When the first purchase price of securities repurchases transaction price difference is to sell short the profits. In fact, the economy is in carrying out the transaction. Investors simply orders to brokers.

Short selling has many limitations. Investors need to maintain short margin positions, as

short selling also needs to cost. However, these two limits of large asset management funds or large companies may not be important. Perhaps there are some in the capital market short selling restrictions; these restrictions may affect the market balance.

(6) Information is symmetric

Assuming the information is symmetric, that all market participants have the same information on asset pricing. In addition, it may face complex issues, such as asymmetric information caused by the net loss.

(7) Investors are rational, the utility of wealth increases the marginal utility of wealth (risk aversion) to reduce

After all market participants to seek risk-adjusted profits. Assuming the same two project risk, investors will choose high-yield projects. Obviously, this assumption is reasonable and important. Researchers cannot imagine the financial risk of investors do not like high profits under the same circumstances. This investor preference is often described as the utility of wealth increases. In other words, investors is richer happier. However, the increase of their happiness with the increase of wealth levels decreased.

Efficient Capital Market Hypothesis

Now suppose that the ideal market for a particular investor behavior. Imagine all investor-owned company profit information and understand their true earnings process and issues related to investors. Moreover, they are changing in real time based on price and personal preferences to adjust its investment portfolio. Company if the transaction price is exactly equal to the present value of future cash flows, it say that capital markets are efficient.

About the definition of efficient markets, the need for "available information" for description. Distinction based on the effectiveness of information collection, efficient market in many forms. Weak form efficiency in the collection of information includes only the historical price and earnings. If the market cannot rely on past prices realized excess profits, then it is the validity of the Weak. For example, if investors realize the difference between the price trends of profits, then the market is not weak form efficient. Semi-strong form efficiency is including all publicly available information. For example, if the published financial reports

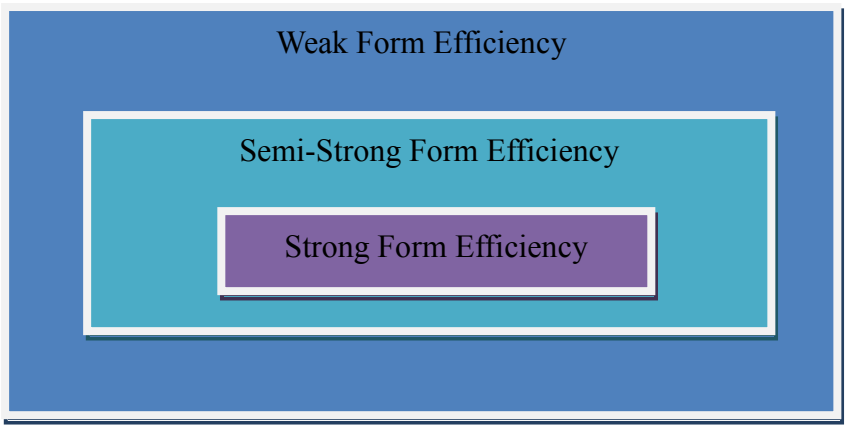
by investors realize excess profits, then the market is not semi-strong form efficiency of the. Strong form efficiency, including all market participants is aware of information (public and private information). It is difficult to prove, as a collection of private information is difficult to obtain.

Empirical evidence would support such a view: the U.S. financial market is at least weak form efficient. That is, only use price charts to predict trends, technical analysis support and breakthroughs, it is difficult to obtain excess returns. The study also supports semi-strong form efficiency, the performance of the company announcements, financial information and other public information in a timely manner shown in the stock price. Strong form efficiency test is difficult, because the "private information" is defined as ambiguous. First of all, why is not public information already reflected in stock prices? If the information is not revealed to the public, it may be and internal transactions. Although there is empirical evidence to support an effective capital market hypothesis, but there is no way to prove market efficiency. There are more than willing to type of public information, there are many ways to use this information. It can only use evidence to refute the market is invalid.

Efficient capital market implications are obvious. An efficient capital market that the company acts is including physical investment, stock payments and other resolutions have been reflected in stock prices. In an efficient capital market, capital market and the physical elements of the market constitute a whole.

There is Chart 2.1 about three effective market relations.

Chart 2.1 Three effective market relations



Tips: Weak form efficient market price reflects the previous information. Semi-strong form efficient market reflects the dividend declared and other public information. Reflect the strong efficient market, including all information, including personal information. Once it knows the market is strong and effective semi-strong form efficient market, semi-strong form efficient market is strong form efficient market. But reverse is not been established.

Market performance of two quantitative methods: an efficient market and perfect market. Perfectly efficient market with different aspects of the market is the market. The number of effective market information tone can be transformed into prices; perfect attention to the securities market makes market participants can trade transactions. Market reflects the risk appetite of investors; investors may hedge the risk or have risk positions. Perfect market is for all market participants to conduct transactions, and effective market price to ensure market supply and demand balance. Balance in the market, no transaction occurs and each investor holds the same portfolio. At this point, the expected profit of certain securities equal to its required return.

2.2.4 Basic Instruments of Capital Markets

Bonds

Bonds are long-term debt obligations issued by corporations, municipalities and government units. Bond issuers promise to pay a specified amount in the future on the maturity of the bond (the face value) plus coupon interest on the borrowed funds.

Bond markets are markets in which bonds are issued and traded. Bond markets are traditionally classified into three types, one is treasury notes and bonds, municipal bonds, and another is corporate bonds.

(1) Treasury notes and bonds

T-notes and T-bonds are issued for financing the national debt and other government expenditures. T-notes have original maturities from 1 to 10 years, T-bonds from 10 to 30 years. T-notes and T-bonds pay coupon interest.

(2) Municipal bonds

Municipal bonds are securities issued by state and local governments to fund either temporary imbalances between operating expenditures and receipts or to finance long-term capital outlays for activities such as school construction, public utility construction, or transportation systems. Tax receipts or revenues generated from a project are the source of repayment on municipal bonds.

(3) Corporate bonds

Corporate bonds are long-term bonds issued by corporations. Primary sales of corporate bond issues occur through a public sale (issue) or a private placement.

Stocks

Stock is ownership of a corporation represented by shared that are a claim on the corporation's earnings and assets. Stock markets are markets in which stocks are issued and traded. The secondary markets for corporate stocks are the most closely watched and reported of all financial security markets. This is because stock markets movements are seen as predictors of economic activity.

There are two types of corporate stock exist, one is common stock another is preferred stock. Both types of stock offer investors a two-part rate of return. The first part is capital gains if the stock appreciates in price over time and the second part is the periodic (generally quarterly) dividend payments to the stockholder.

Common stock entitles the shareholder to vote in the election of directors, preferred stock generally does not confer voting rights.

Preferred stock is a hybrid security that has characteristics of both a bond and a common stock. Preferred stock is similar to common stock in that it represents an ownership interest in the issuing firm, but like a bond it pays a fixed periodic payment. Preferred stock is senior to common stock but junior to bonds, if the issuing firm goes to bankrupt, preferred

stockholders are paid their claim only after creditors have been paid, but before common stockholders are paid.

Dividends on preferred stock are generally fixed and are expressed either as a dollar amount or a percent of the face or par value of the preferred stock.

Forwards and Futures

Forward contract is agreement between a buyer and a seller to exchange. It is a no standardized asset for cash at some future date. The price of the forward contract is fixed over the life of the contract.

Future contract is agreement between a buyer and a seller to exchange a standardized asset for cash at some future date, each contract has a standardized expiration and transactions occur in a centralized market. The price of the futures contract changes daily as the market value of the asset underlying the futures fluctuates.

Options

An option is a contract that gives the holder the right, but not the obligation, to buy or sell an underlying asset at a specified price for a specified time period.

An American option gives the option holder the right to buy or sell the underlying asset at any time before and on the expiration date of the option. A European option gives the option holder the right to buy or sell the underlying asset only on the expiration date.

A call option gives the option buyer the right to buy an underlying security (e.g. stock) at a specified price. In return, the buyer of the call option must pay the seller (writer) a fee known as a call premium. Buying a call option is an appropriate position when the underlying asset's price is expected to rise.

A put option gives the option buyer the right to sell an underlying security at a specified price to the writer of the put option. In return, the buyer of the put option must pay the writer the put premium. Buying a put option is an appropriate when the price on the underlying asset is expected to fall.

Swaps

A swap is an agreement between two parties to exchanges specified periodic cash flows in the future based on some underlying instruments or price. Swaps were first introduced in the early 1980s and the market for swaps has grown enormously in recent years. There are 5 generic types of swaps: interest rate swaps, currency swaps, credit risk swaps, commodity swaps and equity swaps.

Interest rate swap is a succession of forward contracts on interest rates arranged by two parities. The swap buyer agrees to make a number of fixed interest rate payments based on a principal contractual amount on periodic settlement dates to the swap seller. The swap seller, in turn, agrees to make floating-rate payments, tied to some interest rate, to the swap buyer on the same periodic settlement dates.

Funds

To fund is the process of funding, or providing capital funds or other resources for a transaction, a person, a business or other private or public institutions. A fund is usually created through a fundraising, and the purpose can be mutual fund (a specific type of collective investment in the US) and hedge fund (an investment vehicle open only to investors who are qualified in some way).

(1) Mutual fund

A mutual fund is a professionally-managed type of collective investment scheme that pools money from many investors to buy securities (stocks, bonds, short-term money market instruments, and/or other securities). A mutual fund has a fund manager that trades (buys and sells) the fund's investments in accordance with the fund's investment objective. A mutual fund is nothing more than a collection of stocks and/or bonds. It can think of a mutual fund as a company that brings together a group of people and invests their money in stocks, bonds, and other securities. Each investor owns shares, which represent a portion of the holdings of the fund.

(2) Hedge fund

A hedge fund is an investment fund that is typically open to a limited range of investors who pay a performance to the fund's investment manager. Every hedge fund has its own investment strategy that determines the type of investments it undertakes and these strategies are highly individual. As a class, hedge funds undertake a wider range of investment and trading activities than traditional long-only investment funds, and invest in a broader range of assets including long and short positions in shares, bonds and commodities. As the name implies, hedge funds often seek to hedge some of the risks inherent in their investments using a variety of methods, notably short selling and derivatives.

2.3 Financial Institutions

Financial institutions are establishment that focuses on dealing with financial transactions, such as investments, loans and deposits. Conventionally, financial institutions are composed of organizations such as banks, trust companies, insurance companies and investment dealers. Almost everyone has deal with a financial institution on a regular basis. Everything from depositing money to taking out loans and exchange currencies must be done through financial institutions.

Banks

Commercial banks are financial institutions that provide banking and other financial services. They represent the most important financial intermediary. Currently the term bank is generally understood an institution that holds a banking license. Banking licenses are granted by financial supervision authorities and provide rights to conduct the most fundamental banking services such as accepting deposits and making loans.

Banks serve both the private and the public sectors, as their deposit and lending services are utilized by households, businesses and government agencies. The deposits in banks are usually insured by a state agency. Income of banks is derived from investments and fee income. In recent years, banks have begun to offer new services to generate additional income.

These services differ from their traditional operations, they include insurance, underwriting services, mergers and acquisitions services, selling the funds and so on.

Pension Funds

Pension fund is fund set up by a corporation, labor union, governmental entity or other organization to pay the pension benefits of retired workers. Pension funds receive savings of households that are invested in order to provide income during retirement. Moreover, pension funds are frequently part of an employee's benefits package and are managed by investment companies.

Because pension funds are so important for workers, government usually regulates their pension plans. The funds usually have large amounts of money available, which are invested in securities until they are withdrawn by the employees. Due to investing large amounts of money, pension funds provide financing for deficit units, pension funds serve as an important source of funds to corporations and governments.

Insurance Companies

Insurance is the business of providing protection against financial aspects of risk, such as those to property, life, and health etc. In a broad economic sense, insurance transfer risk from individuals to a larger group which is better able to pay for losses. The insurer profits by investing the premiums it receives. By investing the received premiums in financial markets, insurance companies finance the needs of deficit units (corporations and government) and play a major role in these markets. The insurance industry is usually highly regulated and insurance company agents must be licensed

Investment Banking

Investment banking involves the raising of debt and equity securities for corporations and governments. This include origination, underwriting and placement of securities in money and capital markets for corporate or government issuers. Together these services are performed by the investment banking industry and by the securities firms.

The largest companies in this industry perform multiple services. These full-line firms are generally called investment banks. Many other firms concentrate their services in one area only and are called securities firms.

Savings and loan associations

Savings and loan associations are financial institutions which specialize in providing mortgages (mortgages loans) and issuing mortgage-backed securities. Their operations differ from commercial banks, which use most of their funds for business loans and commercial real estate loans. Mortgages have long-term maturities and can usually be prepaid by borrowers. A mortgage normally involves real estate. Mortgages can be sold in the secondary market.

Stock Exchanges

A stock exchange is an organized market for the trading of stocks and bonds (secondary market transactions). Such markets were originally open to all, but at present only members of the owning association may buy and sell directly. Each exchange set its own requirements for membership. Members, or stock brokers, buy and sell for themselves or for others, charging commissions for their services.

Any member of the organized exchange can act both as a seller and a buyer. A stock or bond may be bought or sold only if it is listed on an exchange, and it may not be listed unless it meets certain requirements set by the exchange's board of governors.

There are stock exchanges in all important financial centers of the world; the New York Stock Exchange is the largest in the world, Tokyo, London, Frankfurt and Euro next (Combining facilities in Amsterdam, Brussels, Paris and Lisbon) are also very significant.

3. METODOLOGY OF MODELS OF PORTFOLIO CHOICE

In the chapter 3, there is methodology of models of portfolio choice introduced. It make it 7 sides of that, first one is portfolio management, such as Markowitz portfolio theory and assumptions. Second is theory of the capital asset pricing model (*CAPM*) and the Security Market Line (*CML*). Third are multifactor models of risk and return, like Arbitrage Pricing Theory (*APT*). Fourth is methodology of efficient set construction due to Markowitz model. Fifth is some basic analysis information of financial statements. Sixth are corporate value determination and investment ratios. Last one is security valuation.

3.1 Portfolio Management

3.1.1 Background Assumptions

One basic assumption of portfolio theory is that investors want to maximize the returns from their total set of investments for a given level of risk. During adequately deal with such an assumption requires certain ground rules.

First, the portfolio should include all of assets and liabilities, not only marketable securities but also car, house and less marketable investments such as coins, stamps, art, antiques, and furniture. This full spectrum of investments must be considered because the returns from all these investments interact, and this relationship among the returns for assets in the portfolio is important. Hence, a good portfolio is not simply a collection of individually good investments.

3.1.2 Markowitz Portfolio Theory

In the early 1960s, the investment community talked about risk, but there was no specific measure for the term. To build a portfolio model, however, investors had to quantify their risk variable. The basic portfolio model was developed by Harry Markowitz, who derived the expected rate of return for a portfolio of assets and an expected risk measure.

Markowitz showed that the variance of the rate of return was a meaningful measure of portfolio risk under a reasonable set of assumptions. More important, he derived the formula for computing the variance of a portfolio. This portfolio variance formula not only indicated the importance of diversifying investments to reduce the total risk of a portfolio but also showed how to effectively diversify. The Markowitz model is based on several assumptions regarding investor behavior:

(1) Investors consider each investment alternative as being represented by a probability distribution of expected returns over some holding period.

(2) Investors maximize one-period expected utility, and their utility curves demonstrate diminishing marginal utility of wealth.

(3) Investors estimate the risk of the portfolio on the basis of the variability of expected returns.

(4) Investors base decisions solely on expected return and risk, so their utility curves are a function of expected return and the expected variance (or standard deviation) of returns only.

(5) For a given risk level, investors prefer higher returns to lower returns, similarly, for a given level of expected return, investors prefer less risk to more risk.

Under these assumptions, a single asset or portfolio of assets is considered to be efficient if no other asset or portfolio of assets offers higher expected return with the same (or lower) risk or lower risk with the same (or higher) expected return.

Alternative Measures of risk

One of the vest-know measures of risk is the variance, or standard deviation of expected returns. It is a statistical measure of the dispersion of returns around the expected value whereby a larger variance or standard deviation indicates greater dispersion. The idea is that the more disperse the expected returns, the greater the uncertainty of future returns.

Another measure of risk is the range of returns. It is assumed that a larger range of expected returns, from the lowest to the highest, means greater uncertainty regarding future

expected returns.

Instead of using measures that analyze all deviations from expectations, some observers believe that investors should be concerned only with returns below expectations, which means only deviations below the mean value. A measure that only considers deviations below the mean is the semi variance. An extension of the semi variance measure only computes expected returns below zero (that is, negative returns), or returns below the returns of some specific asset such as T-bills, the rate of inflation, or a benchmark. These measures of risk implicitly assume that investors want to minimize the damage from returns less than some target rate. Assuming that investors should welcome returns above some target rate, the returns above such a target rate are not considered when measuring risk.

Expected rates of return

The expected rate of return for a portfolio of investments is simply the weighted average of the expected rates of return for the individual investments in the portfolio. The weights are the proportion of total value for the individual investment.

Computation of the expected return for the portfolio $E(R_{port})$ as follows:

$$E(R_{port}) = \sum_{i=1}^{n} w_i R_i \quad , \tag{3.1}$$

where w_i is the weight of an individual asset in the portfolio, or the percent of the portfolio in Asset *i*;

R_i is the expected rate of return for Asset *i*.

Variance (Standard Deviation) of returns for an individual investment

It will be using the variance or the standard deviation of returns as the measure of risk. Therefore, at this point we demonstrate how to compute the standard deviation of returns for an individual investment. Subsequently, after discussing some other statistical concepts, it will consider the determination of the standard deviation for a portfolio of investments.

The variance, or standard deviation, is a measure of the variation of possible rates of

return R_i from the expected rate of return $E(R_i)$ as follows:

$$\sigma = \sum_{i=1}^{n} [R_i - E(R_i)]^2 P_i \quad , \tag{3.2}$$

where P_i is probability of the possible rate of return R_i.

$$\sigma = \sqrt{\sum_{i=1}^{n} [R_i - E(R_i)]^2 P_i} \quad , \tag{3.3}$$

Variance (Standard deviation) of returns for a portfolio

Two basic concepts in statistics, covariance and correlation, must be understood before we discuss the formula for the variance of the rate of return for a portfolio.

Covariance of Returns

Covariance is a measure of the degree to which two variables move together relative to their individual mean values over time. In portfolio analysis, it usually is concerned with covariance of rates of return rather than prices or some other variable. A positive covariance means that the rates of return for two investments tend to move in the same direction relative to their individual means during the same time period. In contrast, a negative covariance indicates that the rates of return for two investments tend to move in different directions relative to their means during specified time intervals over time. The magnitude of the covariance depends on the variances of the individual return series, as well as on the relationship between the series.

For two assets, *i* and *j*, it define the covariance of rates of return as:

$$Cov_{ij} = E\{[R_i - E(R_i)][R_j - E(R_j)]\} \quad , \tag{3.4}$$

Covariance and correlation

Covariance is affected by the variability of the two individual return indexes. Obviously, it wants to standardize this covariance measure. It does so by taking into consideration the variability of the two individual return indexes, as follows:

$$r_{ij} = \frac{Cov_{ij}}{\sigma_i \sigma_j}, \quad (3.5)$$

where r_{ij} is the correlation coefficient of returns;

σ_i is the standard deviation of R_{it};

σ_j Is the standard deviation of R_{jt}.

Standardizing the covariance by the product of the individual standard deviations yields the correlation coefficient r_{ij}, which can vary only in the range -1 to +1. A value of +1 indicates a perfect positive linear relationship between R_i and R_j, meaning the returns for the two assets move together in a completely linear manner. A value of -1 indicates a perfect negative relationship between the two return indexes, so that when one asset's rate of return is above its mean, the other asset's rate of return will be low its mean by a comparable amount.

Standard deviation of a portfolio

As noted, a correlation of +1 indicates perfect positive correlation, and a value of -1 means that the returns moved in completely opposite directions. A value of zero means that the returns had no linear relationship, that is, they were uncorrelated statistically. That does not mean that they are independent.

Portfolio standard deviation formula

It can consider the formula for computing the standard deviation of returns for a portfolio of assets, our measure of risk for a portfolio. One might assume it is possible to derive the standard deviation of the portfolio in the same manner, that is, by computing the weighted average of the standard deviations for the individual assets. This would be a mistake. Markowitz derived the general formula for the standard deviation of a portfolio as follows:

$$\sigma_{port} = \sqrt{\sum_{i=1}^{n} w_i^2 \sigma_i^2 + \sum_{i=1}^{n} \sum_{j=1}^{n} w_i w_j Cov_{ij}} \quad (i \neq j), \quad (3.6)$$

where σ_{port} is the standard deviation of the portfolio;

w_i is the weights of an individual asset in the portfolio, where weights are determined by the proportion of value in the portfolio;

$\sigma_{.}$ is the variance of rates of return for asset *i*;

Cov_{ij} is the Covance between the rates of return for assets *i* and *j*, where $Cov_{ij} = {}_{ij}\sigma_{.}\sigma_{.}$.

This formula indicates that the standard deviation for a portfolio of assets is a function of the weighted average of the individual variances (where the weights are squared), plus the weighted covariance between all the assets encompasses not only the variances of the individual assets but also includes the covariance between all the pairs of individual assets in the portfolio. Further, it can be shown that, in a portfolio with a large number of securities, this formula reduces to the sum of the weighted covariance.

Impact of a new security in a portfolio

Although in most of the following discussion it will consider portfolios with only two assets (because it is possible to show the effect in two dimensions), it will also demonstrate the computations for a three-asset portfolio. Still, it is important at this point to consider what happens in a large portfolio with many assets. Specifically, what happens to the portfolio's standard deviation when it add a new security to such a portfolio? As shown by the formula, it sees two effects.

The first is the asset's own variance of returns, and the second is the covariance between the returns of this new asset and the returns of every other asset that is already in the portfolio. The relative weight of these numerous covariance in substantially greater than the asset's unique variance; the more assets in the portfolio, the more this is true. This means that the important factor to consider when adding an investment to a portfolio that contains a number of other investments is not the new security's own variance but the average covariance of this asset with all other investments in the portfolio.

Portfolio standard deviation calculation

Because of the assumptions used in developing the Markowitz portfolio model, any assets or portfolio of assets can be described by two characteristics: the expected rate of return and the expected standard deviation of returns. Therefore, the following demonstrations can be applied to two individual assets, two portfolios of assets, or two asset classes with the indicated rate of return-standard deviation characteristics and correlation coefficients.

A three-asset portfolio

A demonstration of what occurs with a three-asset portfolio is useful because it shows the dynamics of the portfolio process when assets are added. It also shows the rapid growth in the computations required, which is why it will stop at three.

The expected standard deviation of a three-asset portfolio, it is:

$$\sigma_{port} = \sqrt{w_s^2\sigma_s^2 + w_B^2\sigma_B^2 + w_c^2\sigma_c^2 + 2w_s w_B w_c + 2w_s w_c\sigma_s\sigma_c\sigma_{s,c} + 2w_B w_c\sigma_B\sigma_c\sigma_{B,c}}, \quad (3.7)$$

Estimation issues

It is important to keep in mind that the results of this portfolio asset allocation depend on the accuracy of the statistical inputs. In the current instance, this means that for every asset (or asset class) being considered for inclusion in the portfolio, it must estimate its expected returns and standard deviation. It must also estimate the correlation coefficient among the entire set of assets. The number of correlation estimates can be significant. For example, for a portfolio of 100 securities, the number is 4.950 (that is, 90+98+97+…). The potential source of error that arises from these approximations is referred to as estimation risk.

It can reduce the number of correlation coefficients that must be estimated by assuming that stock returns can be described by the relationship of each stock to a market index – that is, a single index market model, as follows:

$$R_i = a_i + b_i R_m + c_i, \quad (3.8)$$

where b_i is the slope coefficient that relates the returns for security *i* to the returns for the aggregate stock market;

R_m is the returns for the aggregate stock market.

If all the securities are similarly related to the market and a slope coefficient b_i is derived for each one, it can be shown that the correlation coefficient between two securities *i* and *j* is:

$$r_{ij} = b_i b_j \frac{\sigma^2}{\sigma \tau}, \quad (3.9)$$

where σ is the variance of returns for the aggregate stock market.

This reduces the number of estimates from 4.950 to 100 – that is, once it has derived a slope estimate b_i for each security, it can compute the correlation estimates. Notably, this assumes that the single index market model provides a good estimate of security returns.

The efficient frontier

The envelope curve that contains the best of all these possible combinations is referred to as the efficient frontier. Specifically, the efficient frontier represents that set of portfolios that has the maximum rate of return for every given level of risk or the minimum risk for every level of return. Every portfolio that lies on the efficient frontier has either a higher rate of return for equal risk or lower risk for an equal rate of return than some portfolio beneath the frontier. Because of the benefits of diversification among imperfectly correlated assets, it would expect the efficient frontier to be made up of portfolios of investments rather than individual securities. Two possible exceptions arise at the end points, which represent the asset with the highest return and the asset with the lowest risk.

As an investor, it's will target a point along the efficient frontier based on utility function, which reflects attitude toward risk. No portfolio on the efficient frontier can dominate any other portfolio on the efficient frontier. All of these portfolios have different return and risk measures, with expected rates of return that increase with higher risk.

The efficient frontier and investor utility

This implies that adding equal increments of risk as it moves up the efficient frontier gives diminishing increments of expected return. To evaluate this situation, it calculates the slope of the efficient frontier as follows:

$$\frac{\Delta\ (R_{port})}{\Delta\ (\sigma_{port})}\ , \qquad (3.10)$$

An individual investor's utility curves specify the trade-offs he or she is willing to make between expected return and risk. In conjunction with the efficient frontier, these utility curves determine which particular portfolio on the efficient frontier best suits an individual investor. Two investors will choose the same portfolio from the efficient set only if their utility curves are identical.

The optimal portfolio is the efficient portfolio that has the highest utility for a given investor. It lines at the point of tangency between the efficient frontier and the curve with the highest possible utility.

3.2 The Capital Asset Pricing Model

Unfortunately, capital market theory is an incomplete explanation for the relationship that exists between risk and return. To understand why, recall that the *CML* defined the risk an investor bears by the total volatility (σ) of the investment. However, since it has seen that investors cannot expect to be compensated for any portion of risk that they could have diversified away (i.e., unsystematic risk), the *CML* must be based on the assumption that investors only hold fully diversified portfolios, for which total risk and systematic risk are the same thing. The limitation is that the *CML* cannot provide an explanation for the risk-return trade-off for individual risky assets because the standard deviation measures for these securities will contain a substantial amount of unique risk.

The capital asset pricing model (*CAPM*) extends capital market theory in a way that allows investors to evaluate the risk-return trade-off for both diversified portfolios and individual securities. To do this, the *CAPM* redefines the relevant measure of risk from total volatility to just the no diversifiable portion of that total volatility (i.e., systematic risk). This new risk measure is called the beta (β) coefficient and it calculates the level of a security's systematic risk compared to that of the market portfolio. Using beta as the relevant measure of risk, the *CAPM* then redefines the expected risk premium per unit of risk in a commensurate fashion. This in turn leads once again to an expression of the expected return that can be

decomposed into the risk-free rate and the expected risk premium.

3.2.1 A Conceptual Development of the CAPM

The *CAPM* requires others, such as that asset returns come from a Normal probability distribution. Rather than repeat the mathematical derivation of the *CAPM*, it will present a conceptual development of the model that emphasizes its role in the natural progression that began with the Markowitz portfolio theory.

Recall that the *CML* expressed the risk-return trade-off for fully diversified portfolios as follows:

$$E(R_{port}) = RFR + \sigma_{port}[\frac{E(R_M) - RFR}{\sigma_M}], \quad (3.11)$$

when trying to extend this expression to allow for the evaluation of any individual risky asset *i*, the logical temptation is to simply replace the standard deviation of the portfolio (σ_{port}) with that of the single security (σ_i). However, as explained above, this would overstate the relevant level of risk in the i-th security because it does not take into account how much of that volatility the investor could diversify away by combining that asset with other holdings. One way to address this concern is to "shrink" the level of σ_i to include only the portion of risk in security *i* that is systematically related to the risk in the market portfolio. This can be done by multiplying σ_i by the correlation coefficient between the returns to security *i* and the market portfolio (r_{iM}). Inserting this product into the *CML* and adapting the notation for the i-th individual asset leaves:

$$E(R_i) = RFR + \sigma_i r_{iM})[\frac{E(R_M) - RFR}{\sigma_M}], \quad (3.12)$$

This expression can be rearranged as:

$$E(R_i) = \text{RFR} + \frac{\sigma_{iM}}{\sigma_{M}^2}[E(R_M) - \text{RFR}] \quad , \qquad (3.13)$$

or:

$$E(R_i) = \text{RFR} + \beta_i [E(R_M) - \text{RFR}] \qquad \text{The equation is the } CAPM. \qquad (3.14)$$

Notice in particular that the *CAPM* redefines risk in terms of a security's beta (β_i), which captures the no diversifiable portion of that stock's risk relative to the market as a whole. Because of this, beta can be thought of as indexing the asset's systematic risk to that of the market portfolio. This leads to a very convenient interpretation: A stock with a beta of 1.20 has a level of systematic risk that is 20% greater than the average for the entire market, while a stock with a beta of 0.70 is 30 less risky than the market. By definition, the market portfolio itself always has a beta of 1.00.

Indexing the systematic risk of an individual security to the market has another nice feature as well. From the *CAPM* equation, it is clear that the *CAPM* once again expresses the expected return for an investment as the sum of the risk-fee rate and the expected risk premium. However, rather than calculate a different risk premium for every separate security that exists, the *CAPM* states that only the overall market risk premium ($E(R_M) - \text{RFR}$) matters and that this quantity can then be adapted to any risky asset by scaling it up or down according to that asset's riskiness relative to the market (β_i). As it will see, this substantially reduces the number of calculations that investors must make when evaluating potential investments for their portfolios.

3.2.2 The Security Market Line

The *CAPM* can also be illustrated in graphical form as the security market line (*SML*).Like the *CML*; the *SML* expresses the trade-off between risk and expected return as a straight line intersecting the vertical axis (i.e., zero-risk point) at the risk-free rate. However,

there are two important differences between the *CML* and the *SML*. First, the *CML* measures risk by the standard deviation (i.e., total risk) of the investment while the *SML* explicitly considers only the systematic component of an investment's volatility. Second, as a consequence of the first point, the *CML* can only be applied to portfolio holdings that are already fully diversified, whereas the *SML* can be applied to any individual asset or collection of assets.

In equilibrium, all assets and all portfolios of assets should plot on the *SML*. That is, all assets should be priced so that their estimated rates of return, which are the actual holding period rates of return that anticipate, are consistent with their levels of systematic risk. Any security with an estimated rate of return that plots above the *SML* would be considered undervalued because it implies that estimated it would receive a rate of return on the security that is above the *SML* would be considered undervalued because it implies that estimated it would receive a rate of return on the security that is above its required rate of return based on its systematic risk. In contrast, assets with estimated rates of return that plot below the *SML* would be considered overvalued. This position relative to the *SML* implies that estimated rate of return is below what it should require based on the asset's systematic risk.

In a completely efficient market, it would not expect any assets to plot off the *SML* because, in equilibrium, all stocks should provide holding period returns that are equal to their required rates of return. Alternatively, a market that is fairly efficient but not completely efficient ma misprices certain assets because not everyone will be aware of all the relevant information for an asset. A superior investor has the ability to derive value estimates for assets that consistently outperform the consensus market evaluation. As a result, such an investor will earn better rates of return than the average investor on a risk adjusted basis.

There are two ways that a stock's beta can be calculated in practice. First, given conceptual discussion of the *CAPM*, a beta coefficient for security i can be calculated directly from the following formula:

$$\sigma = \frac{\sigma}{\sigma}(r_{iM}) = \frac{Cov(R_i, R_M)}{\sigma}, \qquad (3.15)$$

where σ is the return variance for the market portfolio and $Cov(R_i, R_M)$ is the covariance between returns to the security *i* and the market.

Alternatively, security betas can also be estimated as the slope coefficient in a regression equation between the returns to the security (R_{it}) over time and the returns (R_{Mt}) to the market portfolio:

$$R_{it} = \alpha + \beta (R_{Mt}) + \varepsilon_{it}, \qquad (3.16)$$

it is known as the security's characteristic line with the market portfolio.

Where α is the intercept of the regression and e_{it} is the random error term that accounts for the fact that not all of security i's risk is systematically related to the market.

3.3 Multifactor Models of Risk and Return

3.3.1 Arbitrage Pricing Theory

In many respects, the *CAPM* has been one of the most useful - and frequently used - financial economic theories ever developed. However, many of the empirical studies cited point out some of the deficiencies in the model as an explanation of the link between risk and return. For example, tests of the *CAPM* indicated that the beta coefficients for individual securities were not stable but that portfolio betas generally were stable. There was mixed support for a positive linear relationship between rates of return and systematic risk for portfolios of stock, with some recent evidence indicating the need to consider additional risk variables or a need for different risk proxies. In addition, several papers criticized the tests of the model and the usefulness of the model in portfolio evaluation because of its dependence on a market portfolio of risky assets that is not currently available.

One major challenge to the *CAPM* was the set results suggesting that it is possible to use knowledge of certain firm of security characteristics to develop profitable trading strategies, even after adjusting for investment risk as measured by beta. Banz showed that portfolios of stocks with low market capitalizations (i.e., "small" stocks) outperformed "large" stock portfolios on a risk-adjusted basis, and Basu documented that stock with low price

earning (*P/E*) ratios similarly outperformed high *P/E* stocks. More recent work by Fama and French also demonstrates that "value" stocks (i.e., those with high book value-to-market price ratios) tend to produce larger risk-adjusted returns than "growth" stocks (i.e., those with low book-to-market ratios). In an efficient market, these return differentials should not occur, meaning that either: (1) markets are not particularly efficient for extended periods of time (i.e., investors have been ignoring profitable investment opportunities for decades), or (2) market prices are efficient but there is something wrong with the way the single-factor models such as the *CAPM* measure risk.

Given the implausibility of the first possibility, in the early 1970s, financial economists began to consider the implications of the second. The academic community searched for an alternative asset pricing theory to the *CAPM* that was reasonably intuitive, required only limited assumptions, and allowed for multiple dimensions of investment risk. The result was the arbitrage pricing theory (*APT*), which was developed by Ross in the mid-1970s and has three major assumptions:

(1) Capital markets are perfectly competitive.

(2) Investors always prefer more wealth to less wealth with certainty.

(3) The stochastic process generating asset returns can be expressed as a linear function of a set of K risk factors (or indexes), and all unsystematic risk is diversified away.

Equally important, the following major assumptions – which were used in the development of the *CAPM* – are not required: (1) Investors posses' quadratic utility functions, (2) normally distributed security returns, and (3) a market portfolio that contains all risky assets and is mean-variance efficient. Obviously, if such a model is simpler and can also explain differential security prices, it will be considered a superior theory to the *CAPM*.

Prior to discussing the empirical tests of the *APT*, we provide a brief review of the basics of the model. The theory assumes that the stochastic process generating asset returns can be represented as a K factor model of the form:

$$R_i = \text{[illegible]}(R_i) + \text{[illegible]}\delta_{\_} + \text{[illegible]}\delta_{\_} + \cdots + \text{[illegible]}\delta_{\_} + \varepsilon_{\_} \; for\; i = ton, \tag{3.17}$$

where R_i is the actual return on asset *i* during a specified time period, i=1,2,3,…,n;

$E(R_i)$ is the expected return for asset *i* if all the risk factors have zero changes;

b_{ij} is the reaction in asset *i*'s returns to movements in a common risk factor *j*;

δ is a set of common factors or indexes with a zero mean that influences the returns on all assets;

ε_i is a unique effect on asset *i*'s return (i.e., a random error term that, by assumption, is completely diversifiable in large portfolios and has a mean of zero);

n is number of assets.

Two terms require elaboration: δ_j and b_{ij}. As indicated, δterms are the multiple risk factors expected to have an impact on the returns to all assets. Examples of these factors might include inflation, growth in gross domestic product (*GDP*), major political upheavals, or changes in interest rates. The *APT* contends that there are many such factors that affect returns, in contrast to the *CAPM*, where the only relevant risk to measure is the covariance of the asset with the market portfolio (i.e., the asset's beta).

Given these common factors, the b_{ij} terms determine how each asset reacts to the jth particular common factor. Although all assets may be affected by growth in *GDP*, the impact (i.e., reaction) to a factor will differ. For example, stocks of cyclical firms will have larger b_{ij} terms for the "growth in *GDP*" factor than will noncyclical firms, such as grocery store chains. Likewise, all stocks are affected by changes in interest rates; however, some experience larger impacts. An interest-sensitive stock might have an b_j interest of 2.0 or more, whereas a stock that is relatively insensitive to interest rates have an b_j of 0.5. Other examples of common factors include changes in unemployment rates, exchange rates, and yield curve shifts. Note, however, that when it applies the theory, the factors are not identified. That is, when it discuss the empirical studies of the *APT*, the investigators will claim that they found three, four, or

five factors that affect security returns, but they will give no indication of what these factors represent.

Similar to the *CAPM* model, the *APT* assumes that the unique effects (ε) are independent and will be diversified away in a large portfolio. The *APT* requires that in equilibrium the return on a zero-investment, zero-systematic-risk portfolio is zero when the unique effects are fully diversified. This assumption (and some theoretical manipulation using linear algebra) implies that the expected return on any asset *i* (i.e., $E(R_i)$), can be expressed as:

$$E(R_i) = \lambda_0 + \lambda_1 b_{i1} + \lambda_2 b_{i2} + \ldots + \lambda_k b_{ik}, \qquad \text{(APT)} \qquad (3.18)$$

where λ_0 is the expected return on an asset with zero systematic risk;

λ_j is the risk premium related to the jth common risk factor;

b_{ij} is the pricing relationship between the risk premium and the asset; that is, how responsive asset *i* is to the jth common factor. (These are called factor betas or factor loadings).

This equation represents the fundamental result of the *APT*. It is useful to compare the form of the *APT*'s specification of the expected return-risk relationship with that of the *CAPM*.

$$E(R_i) = RFR + \beta_i [E(R_M) - RFR], \qquad \text{(CAPM)} \qquad (3.19)$$

it should be clear that the ultimate difference between these two theories lies in the way systematic investment risk is defined: a single, market-wide risk factor for the *CAPM* versus a few (or several) factors in the *APT* that capture the salient nuances of that market-wide risk. However, both theories specify linear models based on the common belief that investors are compensated for performing two functions: committing capital and bearing risk. Finally, notice that the equation for the *APT* suggests a relationship that is analogous to the security market line associated with the *CAPM*. However, instead of a line connecting risk and

expected return, the *APT* implies a security market plane with (k+1) dimensions –k risk factors and one additional dimension for the security's expected return.

3.3.2 Multifactor Models and Risk Estimation

When it comes to putting theory into practice, one advantage of the *CAPM* framework is that the identity of the single risk factor (i.e., the excess return to the market portfolio) is well specified. The empirical challenge in implementing the *CAPM* is to accurately estimate the market portfolio, a process that first requires identifying the relevant investment universe. This is not a trivial problem as an improperly chosen proxy for the market portfolio (e.g., using the S&P 500 index to represent the market when evaluation a fixed-income portfolio) can lead to erroneous judgments. However, it also saw that once the returns to an acceptable surrogate for the market portfolio are identified (i.e., R_m), the process for estimating the parameters of the *CAPM* is straight forward and can be accomplished by either of the following regression equations:

(1) A security of portfolio's characteristic line can be estimated via regression techniques using the single-index market model:

$$R_{it} = \iota_i + \nu_i R_{mt} + \nu_t .$$

(2) Alternatively, this equation can also be estimated in excess return form by netting the risk free rate from the period t returns to security I and the market portfolio:

$$(R_{it} - \Re FR_t) = \alpha + \nu_i (R_{mt} - \Re FR_t) + \nu_{it} .$$

In contract to the *CAPM*, the primary practical problem associated with implementing the *APT* is that neither the identity nor the exact number of the underlying risk factors are developed by theory and therefore must be specified in an ad hoc manner. Said differently, before the *APT* can be used to value security or measure investment performance, the investor

must fill in a considerable amount of missing information about the fundamental relationship between risk and expected return.

As discussed earlier, the first attempts to implement a usable form of the *APT* relied on multivariate statistical techniques, such as principal components analysis and factor analysis, wherein many periods of realized returns for large number of securities are analyzed simultaneously in order to detect recognizable patterns of behavior. A consistent finding of these studies is that there appear to be as many as three or four "priced" (i.e., statistically significant) factors, although researchers were not able to establish that the same set of factors was generated by different subsets of their sample. Indeed, it also saw that the inability to identify the risk factors is a major limitation to the usefulness of the *APT*. Jones and Ludvigson and Ng provide some recent extensions along these lines.

A different approach to developing an empirical model that captures the essence of the *APT* relies on the direct specification of the form of the relationship to be estimated. That is, in a multifactor model, the investor chooses the exact number and identity of risk factors in the following equation:

$$R_{it} = \alpha_i + [b_{i1}F_{1t} + \beta_{i2}F_{2t} + \ldots + \beta_{ik}F_{kt}] + \varepsilon_{it}, \qquad (3.20)$$

where F_{jt} is the period *t* return to the jth designated risk factor and R_{it} can be measured as either a nominal or excess return to security *i*. The advantage of this approach is that the investor knows precisely how many and what things need to be estimated to fit the regression equation. The major disadvantage of a multifactor model is that it it developed with little theoretical guidance as to the true nature of the risk-return relationship. In this sense, developing a useful factor model is as much an art form as it is a theoretical exercise, see Keith C. Brown (2009)

3.4 Methodology of Efficient Set Construction due to Markowitz Model

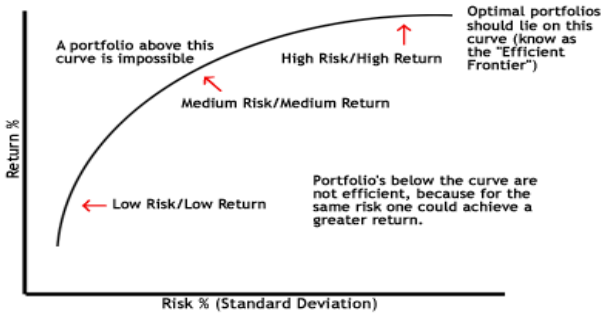
The Markowitz efficient set is all of the portfolios on the efficient frontier, or those that generate the largest return for a given risk level. The mean-variance and subsequent efficient set theory at one time revolutionized portfolio management, and remains a core lecture in any

economist's university years. The theory of mean-variance portfolios lead to the capital asset pricing model, and is still a vital component of professional money management today.

Efficient set composition is a line created from the risk-reward graph, comprised of optimal portfolios.

There is Chart 3.1 about efficient set compositions.

Chart 3.1 Efficient Set Compositions



The optimal portfolios plotted along the curve have the highest expected return possible for the given amount of risk.

Respecting the fact, that there occur three distinct steps, it has to formulate three types of problem. The first step is to find the portfolio with the minimal risk (portfolio A), the second step is to find the portfolio with the maximal expected return (portfolio B). Subsequent steps consist in selecting the portfolios for interior points of the efficient set (portfolios C to H)

There is Table 3.1 about formulation of problem A.

Table 3.1 Formulation of Problem A

the minimum risk portfolio (efficient portfolio A)

Objective Function	$\sigma_r \rightarrow$ in
Constraints	$\sum_i x_i = 1$,
	$x_i \geq$) ,for i=1,2,…N,
	$\sigma_r = \sqrt{\sum_i \sum_j \quad \cdot \sigma_{\cdot} \cdot x_j} = \sqrt{\vec{x}^T \cdot C \cdot \vec{x}}$

Where is standard deviation of the portfolio;

is assets for the portfolio, *i* is number of assets *x*;

is the covariance.

The objective function expresses the minimal standard deviation of the portfolio is looking for. The first constraint states that the sum of relative shares (%) *Xi* is equal to one. Hence, it is allowed to invest just the money amount have held initially. The second constraint is exclude negativity, since short selling is not allowed there. By the last equation that define the calculation of the standard deviation for the optimal portfolio.

There is Table 3.2 about formulation of problem B.

Table 3.2 Formulation of Problem B

	the maximum expected return portfolio (efficient portfolio B)
Objective Function	$E(R_p) \rightarrow$ ax
Constrains	$\sum_i x_i = 1$
	$x_i \geq$) ,for i=1,2…N,

	$E(R_p) = \sum_i \cdot E(R_i) = \vec{\cdot}^T \cdot E(\vec{R})$

The objective function expresses the maximum expected return under given constraints. The first and second constraints are equivalent to the problem A. However, by last equation is defining the calculation of an expected return for the optimal portfolio.

There is Table 3.3 about formulation of problems C to H.

Table 3.3 Formulation of Problems C to H

	Internal points of the efficient set (efficient portfolios C to H)
Objective Function	$\sigma_{\cdot} \rightarrow$ in
Constraints	$\sum_i x_i = 1$
	$x_i \geq$) ,for i=1,2,…N,
	$E(R_p) = \mathrm{Z}(R_{p-\cdot en})$
	$\sigma_{\cdot} = \sqrt{\sum_i \sum_j \overline{\cdot \sigma_{\cdot} \cdot x_j}} = \sqrt{\vec{x}^T \cdot C \cdot \vec{x}}$
	$E(R_p) = \sum_i \cdot E(R_i) = \vec{\cdot}^T \cdot E(\vec{R})$

The aim of this problem is to select an efficient portfolio for a generated mean of the portfolio return. The objective function means the risk (standard deviation) minimization for efficient portfolios. The first and second constraints are defined in the same way as by problem A and B. By the third constraint is ensure that the expected return of the particular efficient portfolio equals to the requested mean return as specified initially for a given

equidistant point.

3.5 Analysis of Financial Statements

Major Financial Statements

Financial statements are intended to provide information on the resources available to management, how these resources were financed, and what the firm accomplished with them. Corporate shareholder annual and quarterly reports include three required financial statements: the balance sheet, the income statement, and the statement of cash flows. In addition, reports that must be filed with the Security and Exchange Commission (*SEC*) carry detailed information about the firm, such as information on loan agreements and data on product line and subsidiary performance. Information from the basic financial statements can be used to calculate financial ratios and to analyze the operations of the firm to determine what factors influence a firm's earnings, cash flows, and risk characteristics.

Balance Sheet

The balance sheet shows what resources (assets) the firm controls and how it has financed these assets. Specifically, it indicates the current and fixed assets available to the firm at a point in time (the end of the fiscal year or the end of a quarter). In most cases, the firm owns these assets, but some firms lease assets on a long-term basis. How the firm has financed the acquisition of these assets is indicated by its mixture of current liabilities (accounts payable or short-term borrowing), long-term liabilities (fixed debt and leases), and owners' equity (preferred stock, common stock, and retained earnings).

Income Statement

The income statement contains information on the operating performance of the firm during some period of time (a quarter of a year). In contrast to the balance sheet, which is at a fixed point in time, the income statement indicates the flow of sales, expenses, and earnings during a period of time.

Statement of Cash Flows

The statement of cash flows integrates the effects on the firm's cash flow of income

flows (based on the most recent year's income statement) and changes on the balance sheet (based on the two most recent annual balance sheets). Analysts use these cash flow values to estimate the value of a firm and to evaluate the risk and return of the firm's bonds and stock.

The statement of cash flows has three sections: cash flows from operating activities, cash flows from investing activities, and cash flows from financing activities. The total cash flows from the three sections are the net change in the cash position of the firm that should equal the difference in the cash balance between the ending and beginning balance sheets.

Purpose of Financial Statement Analysis

Financial statement analysis seeks to evaluate management performance in several important areas, including profitability, efficiency, and risk. Although it will necessarily analyze historical data, the ultimate goal of this analysis is to provide insights that will help their to project future management performance, including pro forma balance sheets, income statements, cash flows, and risk. It is the firm's expected future performance that determines whether it should lend money to a firm or invest in it.

Analysis of Financial Ratios

Analysts use financial ratios because numbers in isolation typically convey little meaning. Thus, ratios are intended to provide meaningful relationship between individual values in the financial statements.

Because the major financial statements report numerous individual items, it is possible to produce a vast number of potential ratios, many of which will have little value.

Importance of Relative Financial Ratios

Just as a single number from a financial statement is of little use, an individual financial ratio has little value except in relation to comparable ratios for other entities. That is, only relative financial ratios are relevant. Therefore, it is important to compare a firm's performance relative to

(1) The aggregate economy

(2) Its industry or industries

(3) Its major competitors within the industry

(4) Its past performance (time-series analysis)

The comparison to the aggregate economy is important because almost all firms are influenced by economic fluctuations.

Probably the most significant comparison relates a firm's performance to that of its industry. Different industries affect the firms within them differently, but this relationship is always significant. The industry effect is strongest for industries with homogeneous products such as steel, rubber, glass, and wood products, because all firms within these industries experience coincidental shifts in demand. In addition, these firms employ fairly similar technology and production processes. As a result, even the best-managed steel firm experiences a decline in sales and profit margins during a recession.

When comparing a firm's financial ratios to industry ratios, investors may not want to use the average (mean) industry value when there is wade variation among firms in the industry. Alternatively, if it believe that a firm has unique component, a cross-sectional analysis in which compare the firm to a subset of industry firms comparable in size or characteristics, may be appropriate.

Finally, Time-series analysis, in which it examines a firm's relative performance over time to determine whether it is progressing or declining, is helpful when estimating future performance.

Financial Risk

Financial risk is the additional uncertainty of returns to equity holder due to a firm's use of fixed financial obligation securities. This financial uncertainty is in addition to the firm's business risk. When a firm sells bonds to raise capital, the interest payments on this capital precede the computation of common stock earnings, and these interest payments are fixed contractual obligations. As with operating leverage, during an economic expansion, the net earnings available for common stock after the fixed interest payments will experience a larger percentage increase than operating earnings. In contrast, during a business decline, the earnings available to stockholders will decline by a larger percentage than operating earnings

because of this fixed financial cost (i.e., interest payments). Notably, as a firm increases its relative debt financing with fixed contractual obligations, it increases its financial risk and the possibility of default and bankruptcy.

Relationship between Business Risk and Financial Risk

A very important point to remember is that the acceptable level of financial risk for a firm depends on its business risk. If the firm has low business risk (i.e., stable operating earnings), investors are willing to accept higher financial risk. In contrast, if a firm is in an industry that is subject to high business risk (i.e., it experiences high sales volatility and it has high operating leverage), such as steel, auto, and airline companies, an investor would not want these firms to also have high financial risk. The two risks would compound and the probability of bankruptcy would be substantial.

In analysis, it employs three sets of financial ratios to measure financial risk, and all three sets should be considered. First, there is balance sheet ratios that indicate compared the proportion of capital derived from debt securities to equity capital. Second are ratios that compare the earnings or cash flows available and relate these cash flows to the book value of the outstanding debt.

Analysis of Growth Potential

The growth of business, like the growth on any economic entity, including the aggregate economy, depends on

(1) The amount of resources retained and reinvested in the entity

(2) The rate of return earned on the reinvested funds

The more a firm reinvests, the greater it's potential for growth. Alternatively, for a given level of reinvestment, a firm will grow faster if it earns a higher rate of return on the funds reinvested. Therefore, the growth rate of equity earnings and cash flows is a function of two variables: the percentage of net earnings retained (the firm's retention rate) and the rate of return earned on the firm's equity capital (the firm's *ROE*), because when earnings are retained they become part of the firm's equity.

, (3.21)

where *g* is potential (i.e., sustainable) growth rate;

RR is the retention rate of earnings;

ROE is the firm's return on equity.

The retention rate is a decision by the board of directors based on the investment opportunities available to the firm. Theory suggests that the firm should retain earnings and reinvest them as long as the expected rate of return on the investment exceeds the firm's cost of capital.

A firm's *ROE* is a function of three components:

(1) Net profit margin

(2) Total asset turnover

(3) Financial leverage (total assets/equity)

Therefore, a firm can increase its *ROE* by increasing its profit margin, by becoming more efficient (increasing its total asset turnover), or by increasing its financial leverage (and its financial risk).

———————— , (3.22)

This analysis indicates that the important consideration is the long-run outlook for the components of return on equity. Investors need to project changes in each of the components of *ROE* and employ these projections to estimate an *ROE* to use in the growth model along with an estimate of the firm's long-run retention rate.

3.6 Determinants of Corporate Value

3.6.1 Corporate Valuation

The value of public companies is determined by the stock market. The value of companies not publicly quoted will be greatly influenced by the same market. The main stock

market related ratios, there are:

(1) Market capitalization

(2) Share values, nominal, book, market

(3) Earnings per share (*EPS*)

(4) Dividends per share (*DPS*)

(5) Dividend cover and the pay-out ratio

(6) Earnings yield

(7) Dividend yield

(8) Price to earnings ratio (*PE*)

(9) Market to book ratio

Market value is the price quoted in the Stock Exchange for a public company or an estimated price for a non-quoted company. On the Stock Exchange the figure changes daily in response to actual or anticipated results and overall or sect oral sentiment of the market as reflected in the Stock Exchange indices. It is suggested that the main objective of management is to secure the best price possible under any set of conditions.

Earnings per share are one of the most widely quoted statistics when there is a discussion of a company's performance or share value. The earnings after tax (*EAT*) are divided by the number of common shares to calculate the value of earnings per share. It serves no purpose to compare the earnings per share in one company with that in another because a company can elect to have a large number of shares of low denomination or a smaller number of a higher denomination. A company can also decide to increase or reduce the number of shares on issue. This decision will automatically after the earnings per share.

While the absolute amount of earnings per share tells nothing about a company's performance, the growth in *EPS* over time is a very important statistic. Indeed, many chairpersons stress it as a prime target in annual reports. Furthermore, growth in earnings per share has a significant influence on the market price of the share.

Growth in *EPS* tells us more about a company's progress than growth in absolute profits. Growth in profits can result from a great many things. For instance, a company could acquire another for shares and thereby increase its profit. However, if the percentage increase in profit is less than the percentage increase in the number of shares, earnings per share will fall even with higher profits. Not only is growth in *EPS* most important, so also is its stability. Investors look closely at the quality of earnings. They dislike the erratic performance of companies with widely fluctuating profits. A high-quality rating is given to earnings that are showing steady, non-volatile growth.

The total return to the shareholder over any given time consists of the dividend received plus the growth in the share price. While for some investors growth is most important, many shareholders and potential investors – both private individuals and institutions such as pension funds who need income for their day-to-day affairs – pay very close attention to dividends. It looks at the absolute dividend per share and for a history of stable but growing payments. Therefore companies dislike intensely having to reduce the dividend because this will drive away investors with possibly serious effects on share price. A company in a difficult year will often decide that it must pay a dividend in excess of earnings rather than cut the pay-out. Of course, this policy can be followed only for a short time and when there is reason to believe that earnings will recover to a greater than the dividends.

The importance of the dividend's cover is the indication it gives of the future stability and growth of the dividends:

(1) A high cover (low pay-out ratio) suggests that the dividend is fairly safe, because it can be maintained in the face of any expected downturn in profit.

(2) A high cover also indicates a high retention policy, which suggests that the company is aiming for high growth.

Whereas the earning yield specifies the total return, the dividend yield is more important for investors dependent on income from the shares. It allows them to compare the cash flow that they will receive from investing a fixed sum in different stocks or other investment outlets. In the previous section, public utility companies with high payout ratio

tend to produce high dividend yields and would be popular with pension fund managers.

The advantages of a high price to earnings ratio value are considerable. The wealth of the company's owners is increased in proportion. New funds can be raised at a favorable price. The possibility of a successful hostile takeover bid is much reduced. Most importantly, the company has the means to make acquisitions on favorable terms by using its shares, as opposed to cash.

3.6.2 Investment Ratios

Equity analysts generally use indirect methods of share valuation rather than valuing future dividends directly. These methods often involve the use of key investment ratios such as the dividend yield and the *price / earnings* ratios.

Dividend yield is the gross annual dividend per share divided by the current share price in the market. It is an indication of the current level of income from a share. It define dividend yield using a forecast gross dividend per share d_1 although published dividend yield in the financial press are usually based on the actual historic gross dividend.

—, (3.23)

Price / earnings ratio is the current share price in the market expressed as a multiple of net earnings per share. Again, our definition is based on forecast net earnings per share e_1 for the current year, whereas the financial press tends to quote *price / earnings* ratios based on the latest reported net earnings per share.

— , (3.24)

Assuming that annual dividends are expected to grow at a constant rate, it can use *price/earnings* ratio to isolate the factors which should influence the investor's required dividend yield and required *price/earnings* ratio .

Rearranging equation (3.24),

— , (3.25)

Thus, the investor's required dividend yield is simple the required return r less the expected dividend growth rate g. If the actual dividend yield based on a dividend forecast and the current market price is greater (or less) than the required dividend yield, the share is cheap (expensive).

Dividing equation (3.24) by prospective net earnings per share from which the next dividend is paid,

$$\frac{}{} = \frac{}{}, \tag{3.26}$$

Thus, the investor's required price/earnings ratio reflects the estimated ratio, the required return and dividend growth expectations. If the actual *price/earnings* ratio based on an earnings forecast and the current market price is greater (or less) than the required *price/earnings* ratio, the share is expensive (or cheap).

Average *price/earnings* ratios across international markets very considerably, reflecting differences in the proportion of earnings paid out in dividends, required returns and dividend growth expectations. Furthermore

(1) Net earnings per share are not calculated on a consistent basis over different national markets;

(2) Equities in different national markets may not be efficiently priced, one relative to another; and

(3) The tax treatment of dividends is not standardized internationally.

The value of a company's underlying net assets is sometimes used as a measure of fundamental value, particularly in a takeover or liquidation situation, or for companies which are investment vehicles for specific types of assets (e.g. UK investment trusts or US closed-end funds). For a continuing business, however, earnings and dividends are generally more important than net asset value.

3.7 An Introduction to Security Valuation

Once you have determined this rate, some investment alternatives, such as savings accounts and T-bills, are fairly easy to evaluate because they provide stated cash flows. Most investments have expected cash flows and a stated market price (for example, common stock), and it must estimate a value for the investment to determine if its current market price is consistent with your estimated intrinsic value. It must estimate the intrinsic value of the security based on its expected cash flows and required rate of return. After it has completed estimating a security's intrinsic value, compare this estimated intrinsic value to the prevailing market price to decide whether want to buy the security or not.

The investment decision process is similar to the process follow when deciding on a corporate investment or shopping. In each case, it examines the item and decides how much it is worth to you (its value). If the price equals its estimated value or is less, it would buy it. The same technique applies to securities except that the determination of a security's value is more formal.

There are two generally approaches to the valuation process:

(1) The top-down, three-step approach.

(2) The bottom-up, stock valuation, stock picking approach.

Both of these approaches can be implemented by either fundamentalists or technicians. The difference between the two approaches is the perceived importance of the economy and a firm's industry on the valuation of a firm and its stock.

Advocates of the top-down, three-step approach believe that both the economy/market and the industry effect have a significant impact on the total returns for individual stocks. In contrast, those who employ the bottom-up, stock picking approach contend that it is possible to find stocks that are undervalued relative to their market price, and these stocks will provide superior returns regardless of the market and industry outlook.

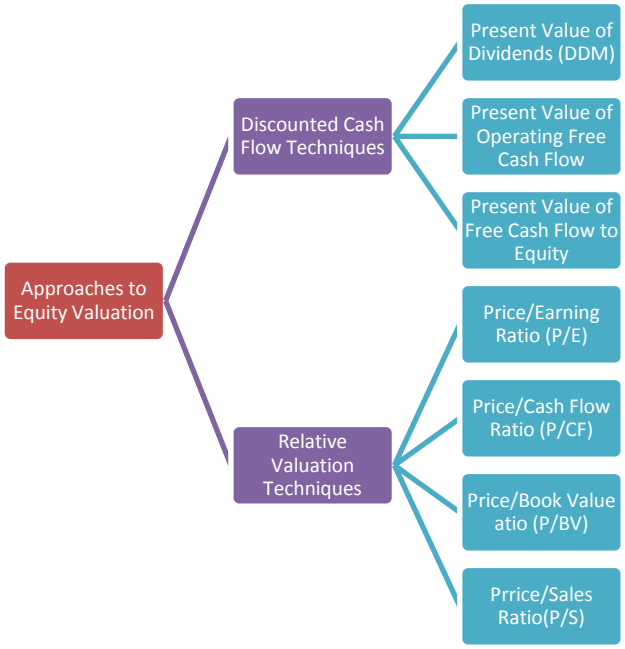
Both of these approaches have numerous supporters, and advocates of both approaches have been quite successful. Although believe that the economic environment and the performance of a firm's industry influence the value of a security and its rate of return.

Because of the importance of these economic and industry factors, it presents an overview of the valuation process that describes these influences and explains how they can be incorporated into the analysis of a security's value.

See Ciaran Walsh (2003)

There is Chart 3.2 about the approaches to equity valuation.

Chart 3.2 Approaches to Equity Valuation



Discounted Cash Flow Valuation Techniques

All of these valuation techniques are based on the basic valuation model, which assets that the value of an asset is the present value of its expected future cash flows as follows:

$$V_j = \sum_{i=1}^{n} \frac{CF_t}{(1+k)^t}, \tag{3.27}$$

where V_j is value of stock j;

n is life of the asset;

CF_t is cash flow in period t.

k is the discount rate that is equal to the investors' required rate of return for asset j, which is determined by the uncertainty (risk) of the asset's cash flows.

The specific cash flows used will differ between techniques. They range from dividends to operating free cash flow and free cash flow to equity.

The Dividend Discount Model (DDM)

The dividend discount model assumes that the value of a share of common stock is the present value of all future dividends as follows:

, (3.28)

where V_j is value of common stock j;

D_t is dividend during period t;

k is required rate of return on stock j.

Infinite Period Model

The easiest assumption is that the future dividend stream will grow at a constant rate for an infinite period. This is a rather heroic assumption in many instances, but where it does hold, it can use the model to value individual stocks as well as the aggregate market and alternative industries. The model is generalized as follows:

$$V_j = \frac{D_0(1+g)}{(1+k)} + \frac{D_0(1+g)^2}{(1+k)^2} + \ldots + \frac{D_0(1+g)^n}{(1+k)^n}, \quad (3.29)$$

where V_j is the value of stock j;

D_0 is the dividend payment in the current period;

g is the constant growth rate of dividends;

k is the required rate of return on stock j;

n is the number of periods, which we assume to be infinite.

Present Value of Operating Free Cash Flows

In this model, it is deriving the value of the total firm because they are discounting the operating free cash flows prior to the payment of interest to the debt holders but after deducting funds needed to maintain the firm's asset base (capital expenditures). Also, because they are discounting the total firm's operating free cash flow, it would use the firm's weighted average cost of capital ($WACC$) as discount rate. Therefore, once estimate the value of the total firm, subtract the value of debt, assuming the goal is to estimate the value of the firm's equity. The total value of the firm is equity to:

$$V_j = \sum_{i=1}^{n} \frac{OFCF_t}{(1+WACC_j)^t}, \tag{3.30}$$

where V_j is value of firm j;

n is number of periods assumed to be infinite;

$OFCF_t$ is the firm's operating free cash flow in period t;

$WACC_t$ is firm j's weighted average cost of capital.

Present Value of Free Cash Flows to Equity

The third discounted cash flow technique deals with "free" cash flows to equity, which would be derived after operating free cash flows, have been adjusted for debt payments (interest and principal). Also, these cash flows precede dividend payments to the common stockholder. Such cash flows are referred to as free because they are what are left after providing the funds needed to maintain the firm's asset base. They are specified as free cash flows to equity because they also adjust for payments to debt holders and to preferred stockholders.

Because these are cash flows available to equity owners, the discount rate used is the

firm's cost of equity (*k*) rather than the firm's *WACC*.

$$V_j = \sum_{i=1}^{n} \frac{FCFE_t}{(1+k_j)^t}, \qquad (3.31)$$

where V_j is value of the stock of firm *j*;

n is number of periods assumed to be infinite;

$FCFE_t$ is the firm's free cash flow to equity in period *t*.

Again, how an analyst would implement this general model depends on the firm's position in its life cycle. That is, if the firm is expected to experience stable growth, analysts can use the infinite growth model. In contrast, if the firm is expected to experience a period of temporary supernormal growth, analysts should use the multistage growth model similar to the process used with dividends and for operating free cash flow.

Earnings Multiplier Model

In the case of common stocks, the returns that investors are entitled to receive are the net earnings of the firm. Therefore, one way investors can estimate value is by determine how many dollars they are willing to pay for a dollar of expected earnings. Referred to as the *price/earnings* (*P/E*) ratio, as follows:

———————— , (3.32)

The computation of the current earnings multiplier (*P/E* ratio) indicates the prevailing attitude of investors toward a stock's value. Investors must decide if they agree with the prevailing *P/E* ratio for the aggregate market, for the firm's industry, and for similar firms and stocks.

The Price/Cash Flow Ratio

The growth in popularity of the relative *price/cash* flow valuation ratio can be traced to concern over the propensity of some firms to manipulate earnings per share, whereas cash

flow values are generally less prone to manipulation. The price to cash flow ratio is computed as follows:

$$P/CF_j = \frac{P_t}{CF_{t+}}, \tag{3.33}$$

where P/CF_j is the *price/cash flow* ratio for firm *j*;

P_t is the price of the stock in period *t*;

CF_t is the expected cash flow per share for firm *j*.

Regarding what variables affect this valuation ratio, the factors are similar to the *P/E* ratio. Specifically, the main variables should be: the expected growth rate of the cash flow variable used, and the risk of the stock as indicated by the uncertainty or variability of the cash flow series over time. The specific cash flow measure used will vary depending on the nature of the company and industry and which cash flow specification is the best measure of performance for this industry. An appropriate ratio can also be affected by the firm's capital structure.

The Price/Book Value Ratio

The *price/book value* (*P/BV*) ratio has been widely used for many years by analysts in the banking industry as a measure of relative value. The book value of a bank is typically considered a good indicator of intrinsic value because most bank assets, such as bonds and commercial loans, have a value equal to book value. This ratio gained in popularity and credibility as a relative valuation technique for all types of firms indicated a significant inverse relationship between *P/BV* ratios and excess rates of return for a cross section of stocks. The *P/BV* ratio is specified as follows:

$$P/BV_j = \frac{P_t}{BV_{t+}}, \tag{3.34}$$

where P/BV_j is the price/book value ratio for firm *j*;

P_t is the price of the stock in period *t*;

BV_{t+} is the estimated end-of-year book value per share for firm *j*.

As with other relative valuation ratios, it is important to match the current price with the future book value that is expected to prevail at the end of the year. The difficulty is that this future book value is not generally available. One can derive an estimate of the end-of-year book value based on an estimate of net earnings minus the expected dividends (which is added to retained earnings). The growth rate for the series can be estimated using the growth rate implied by the sustainable growth formula: *g= (ROE)* (Retention Rate).

Regarding what factors determine the size of the *P/BV* ratio, it is a function of the firm's *ROE* relative to its cost of equity since the ratio would be one if they were equal – that is, if the firm earned its required return on equity. In contrast, if the firm's *ROE* is much larger than its cost of equity, it is a growth company and investors should be willing to pay a premium price over its book value for the stock.

The Price/Sales Ratio

These advocates consider this ratio meaningful and useful for two reasons. First, they believe that strong and consistent sales growth is a requirement for a growth company. Although they note the importance of an above – average profit margin, they contend that the growth process must begin with sales. Second, given all the data in the balance sheet and income statement, sales information is subject to less manipulation than any other data item. The specific *P/S* ratio is:

$$P/S_j = \frac{P_t}{S_{t+}}, \tag{3.35}$$

where P/S_j is the price to sales ratio for firm *j*;

P_t is the price of the stock in period *t*;

S_{t+} is the expected sales per share for firm *j*.

Again, it is important to match the current stock price with the firm's expected sales per share, which may be difficult to derive for a large cross section of stocks. Two caveats are relevant to the price to sales ratio. First, this particular relative valuation ratio varies dramatically by industry. The second consideration is in the profit margin on sales. Therefore, relative valuation analysis using the *P/S* ratio should be between firms in the same or similar industries.

4. APPLICATION OF OPTIMAL EQUITY PORTFOLIO COMPOSITION

In the chapter 4, there are two sides to describe calculation part. The first is *CAMP* application; it is going to write the *CAPM* input data description and mathematical valuation. Second part is efficient set composition; it is going to write the input data description and procedure of efficient set composition. Then it will get the result and make solution of that.

4.1 CAPM Model Application

I have chosen 30 firms of securities to make portfolio, there are firms from the US, the UK, Japan and China (include Hong Kong) Stock Exchange Market. Subsequently, the expected return and standard deviation is calculated for 30 assets. *CAPM* model is applied for expected return of assets calculation.

4.1.1 Input Data of CAPM model

There is in the Table 4.1 rates of foreign countries. In theory, stocks should provide a greater return than safe investments. The difference is called the equity risk premium: it is the excess return that you can expect from the overall market above a risk-free return. The equity premium helps to set portfolio return expectations and determine asset allocation policy. A higher premium, for instance, implies that you would invest a greater share of your portfolio

into stocks. Also, the capital asset pricing relates a stock's expected return to the equity premium: a stock that is riskier than the market - as measured by its beta - should offer excess return above the equity premium.

The risk free rate of return is the best rate that does not involve taking a risk. Both the return of the original capital and the payment of interest are completely certain. The risk free rate for a given period is taken to be the return on government bonds over the period. This is because a government cannot run out of its own currency, as it is able to create more as necessary. Any other investment should produce greater returns than the risk free rate. The extra return (the risk premium) reflects the extra risk involved. The risk free rate is used by the *CAPM* and other valuation models.

Table 4.1 Risk Premium and Risk Free Rate for foreign countries

	Risk Premium [E(RM)-RFR]	**Risk Free Rate** RFR
US	5,00%	0,25%
UK	5,00%	0,5%
JAPAN	5,75%	0,1%
CHINA	6,05%	6,06%
HONG KONG	5,38%	0,50%

There is in the Table 4.2 input data for *CAPM* model calculation, e.g. beta coefficient, *P/E* ratio, *EPS*, *ROI* and *ROE*.

Beta is a measure of a stock's volatility in relation to the market. By definition, the market has a beta of 1.0, and individual stocks are ranked according to how much they deviate from the market. A stock that swings more than the market over time has a beta above 1.0. If a stock moves less than the market, the stock's beta is less than 1.0. High-beta stocks are supposed to be riskier but provide a potential for higher returns; low-beta stocks pose less risk but also lower returns. Beta is a key component for the capital asset pricing model (*CAPM*), which is used to calculate cost of equity. Recall that the cost of capital represents the discount

rate used to arrive at the present value of a company's future cash flows. All things being equal, the higher a company's beta is, the higher its cost of capital discount rate. The higher the discount rate, the lower the present value placed on the company's future cash flows. In short, beta can impact a company's share valuation.

EPS is important to company analysis because it measures profitability on a per-unit basis in the same way that a share price is a per-unit measure. *EPS* is the measure of income belonging to one share of stock. The evaluation of earnings per share should be a relatively straightforward process, High-quality *EPS* means that the number is a relatively true representation of what the company actually earned (i.e. cash generated). But while evaluating *EPS* cuts through a lot of the accounting gimmicks, it does not totally eliminate the risk that the financial statements are misrepresented. While it is becoming harder to manipulate the statement of cash flows, it can still be done. A low-quality *EPS* number does not accurately portray what the company earned. To determine earnings quality, investors can rely on operating cash flow. The company can show positive earnings on the income statement while also bearing a negative cash flow.

Stock's *P/E* tells us how much investor is willing to pay per dollar of earnings. For this reason it's also called the "multiple" of a stock. Although the *EPS* figure in the *P/E* is usually based on earnings from the last four quarters, the *P/E* is more than a measure of a company's past performance. It also takes into account market expectations for a company's growth. Remember, stock prices reflect what investors think a company will be worth. Future growth is already accounted for in the stock price. As a result, a better way of interpreting the *P/E* ratio is as a reflection of the market's optimism concerning a company's growth prospects. If a company has a *P/E* higher than the market or industry average, this means that the market is expecting big things over the next few months or years. A company with a high *P/E* ratio will eventually have to live up to the high rating by substantially increasing its earnings, or the stock price will need to drop. But it's difficult to determine whether a particular *P/E* is high or low without taking into account two main factors. One is company growth rates - How fast has the company been growing in the past, and are these rates expected to increase, or at least continue, in the future? Something isn't right if a company has only grown at 5% in the past

and still has a stratospheric *P/E*. If projected growth rates don't justify the *P/E*, then a stock might be overpriced. In this situation, all you have to do is calculate the *P/E* using projected *EPS*. Second one is industry - It is only useful to compare companies if they are in the same industry. For example, utilities typically have low multiples because they are low growth, stable industries. In contrast, the technology industry is characterized by phenomenal growth rates and constant change. Comparing a tech company to a utility is useless. You should only compare high-growth companies to others in the same industry, or to the industry average.

To compare the *P/E* and *EPS* that is the current price of a stock divided by some *EPS* measure. *P/E* ratios are used widely to value stocks and predict future stock prices, which makes *EPS* a highly important measure for common stock evaluation. Analysts often use financial models to project *EPS* for some future time period, which involves projecting both income and the complex share count figures. Analysts then multiply the *EPS* projection by some projected *P/E* ratio to arrive at a target price for the stock. These target prices often drive recommendations on stocks. All else being equal, the only way to grow the individual shareholder's claim to profits - and generate return on investment - is to increase *EPS*. Increasing income alone is not enough. If the company issues a lot of stock and common stock equivalents over time, *EPS* may not increase (indeed, it may decrease) even though income has been rising. Therefore, company management teams must make appropriate decisions to both maximize profitability and keep a handle on share issuances at the same time.

Table 4.2 Assets of equity portfolio data (http://www.reuters.com data time is 2011 March)

Firms		Country	No.	Beta β	P/E (TTM)	EPS (TTM)	ROI	ROE
Williams Sonoma Inc	WSM	US	A1	1,68	21,32	161,76	13,19	16,21
STR Holdings Inc New	STRI.N	US	A2	1,41	16,08	93,07	7,88	16,46
Energy Solutions Inc	ES	US	A3	1,35	-	-166,77	-1,08	-4,38
Heckmann Corp	HEK	US	A4	0,74	-	96,20	-4,41	-4,80

Verifone Systems Inc	PAY	US	A5	1,94	38,21	221,02	15,36	68,16
Microsoft Corp	MSFT.O	US	A6	1,05	10,76	29,84	33,07	44,34
Intelligent Systems Corp	INS	US	A7	0,85	32,90	134,08	12,28	12,61
Impax Laboratories Inc	IPXL.O	US	A8	1,12	6,64	375,88	48,93	68,61
Alpha Pro Tech Ltd	APT	US	A9	1,07	8,32	-17,67	14,26	14,65
Sunlink Health Systems Inc	SSY	US	A10	1,56	-	-391,22	-9,23	-14,61
DTZ Hldgs PLC	DTZ.L	UK	A11	0,75	-	93,27	-4,92	-24,06
International Ferro Metals Ltd	IFL.L	UK	A12	1,95	-	81,91	-3,06	-3,53
Southern Cross Healthcare Group PLC	SCHE.L	UK	A13	1,63	-	-66,06	-10,57	-52,35
Helphire Group PLC	HHR.L	UK	A14	0,77	7,72	104,86	2,64	6,63
Exillon Energy Plc	EXIL.L	UK	A15	0,43	2,68	-	-	-
Admiral Group Public Limited Company	ADML.L	UK	A16	0,76	21,90	22,62	-	59,58
Associated British Foods PLC	ABF.L	UK	A17	0,67	13,57	52,25	8,78	10,88
Compass Group PLC	CPG.L	UK	A18	0,67	15,18	19,14	13,98	23,63
Experian PLC	EXPN.L	UK	A19	0,72	22,98	18,07	10,46	24,03
BP PLC	BP	UK	A20	1,11	-	-123,58	-1,83	-3,79
TOKYO KIKAI SEISAKUSHO LTD	6335.T	JAPAN	A21	0,82	-	-	-	-
KANEMATSU-NNK CORP	7961.T	JAPAN	A22	2,06	-	-	-	-
Nissei Build Kogyo Company Limited	1916.T	JAPAN	A23	0,84	-	-	-	-
Pixela Corp	6731.T	JAPAN	A24	1,15	3,13	-	71,99	131,66
TOKYO KEIKI INC	7721.T	JAPAN	A25	1,16	-	-	-	-
Aeolus Tyre Co Ltd	600469.SS	CHINA	A26	0,85	27,73	-50,77	5,80	8,76
Beijing Aritime Intelligent Control Co Ltd (600560.SS)	600560.SS	CHINA	A27	0,93	43,95	50,22	10,89	10,49
China Resources Enterprise Ltd (0291.HK)	0291.HK	HONG KONG	A28	1,07	24,74	41,39	9,56	10,04
Hang Seng Bank Ltd (0011.HK)	0011.HK	HONG KONG	A29	0,83	15,65	13,54	-	22,57

Citic Pacific Ltd	0267.HK	HONG KONG	A30	1,88	8,72	48,81	7,55	13,87

4.1.2 Mathematical Valuation of CAPM

Now, known the beta, risk premium and risk free rate, I can apply the *CAPM* model to calculate expected return.

As before the formula (3.14), the *CAPM* mathematical function is

. Where *RFR* is risk free rate, E(RM)-RFR is risk premium. There is in the Table 4.3 results of calculation.

CAPM model presents a very simple theory that delivers a simple result. The theory says that the only reason an investor should earn more, on average, by investing in one stock rather than another is that one stock is riskier. The big sticking point is beta. The linear relationship between beta and individual stock returns also breaks down over shorter periods of time. Although it is difficult to predict from beta how individual stocks might react to particular movements, investors can probably safely deduce that a portfolio of high-beta stocks will move more than the market in both direction, and a portfolio of low-beta stocks will move less than the market. This is important for investors - especially fund managers because they may be unwilling to or prevented from holding cash if they feel that the market is likely to fall. If so, they can hold low-beta stocks instead. Investors can tailor a portfolio to their specific risk-returnrequirements, aiming to hold securities with betas in excess of 1 while the market is rising, and securities with betas of less than 1 when the market is falling. *CAPM* contributed to the rise in use of indexing - assembling a portfolio of shares to mimic a particular market - by risk adverse investors. This is largely due to *CAPM*'s message that it is only possible to earn higher returns than those of the market as a whole by taking on higher risk (beta).

Table 4.3 Expected return results

Assets	Function	Expected Return E(Ri)

Williams Sonoma Inc	0,25%+1,68·5,00%	8,65%
STR Holdings Inc New	0,25%+1,41·5,00%	7,3%
Energy Solutions Inc	0,25%+1,35·5,00%	7%
Heckmann Corp	0,25%+0,74·5,00%	3,95%
Verifone Systems Inc	0,25%+1,94·5,00%	9,95%
Microsoft Corp	0,25%+1,05·5,00%	5,5%
Intelligent Systems Corp	0,25%+0,85·5,00%	4,5%
Impax Laboratories Inc	0,25%+1,12·5,00%	5,85%
Alpha Pro Tech Ltd	0,25%+1,07·5,00%	5,6%
Sunlink Health Systems Inc	0,25%+1,56·5,00%	8,05%
DTZ Hldgs PLC	0,5%+0,75·5,00%	4,25%
International Ferro Metals Ltd	0,5%+1,95·5,00%	10,25%
Southern Cross Healthcare Group PLC	0,5%+1,63·5,00%	8,65%
Helphire Group PLC	0,5%+0,77·5,00%	4,35%
Exillon Energy Plc	0,5%+0,43·5,00%	2,65%
Admiral Group Public Limited Company	0,5%+0,76·5,00%	4,3%

Associated British Foods PLC	0,5%+0,67·5,00%	3,85%
Compass Group PLC	0,5%+0,67·5,00%	3,85%
Experian PLC	0,5%+0,72·5,00%	4,1%
BP PLC	0,5%+1,11·5,00%	6,05%
TOKYO KIKAI SEISAKUSHO LTD	0,1%+0,82·5,75%	4,815%
KANEMATSU-NNK CORP	0,1%+2,06·5,75%	11,945%
Nissei Build Kogyo Company Limited	0,1%+0,84·5,75%	4,93%
Pixela Corp	0,1%+1,15·5,75%	6,7125%
TOKYO KEIKI INC	0,1%+1,16·5,75%	6,77%
Aeolus Tyre Co Ltd	6,06%+0,85·6,05%	11,2025%
Beijing Aritime Intelligent Control Co Ltd (600560.SS)	6,06%+0,93·6,05%	11,6865%
China Resources Enterprise Ltd (0291.HK)	0,50%+1,07·5,38%	6,2566%
Hang Seng Bank Ltd (0011.HK)	0,50%+0,83·5,38%	4,9654%
Citic Pacific Ltd	0,50%+1,88·5,38%	10,6144%

4.2 Efficient Set Composition due to Markowitz model

Suppose that there is manager of a stock portfolio and have at the disposal 30 stocks

which are from the international financial market, that are from the US, the UK, Japan and China (including Hong Kong). For a given investment horizon expected returns and the covariance matrix C are known.

Task is to select the optimal relative composition of 8 efficient portfolios on the basis of the Markowitz model. Returns of efficient portfolios are at equidistant points. Description of the model is in the chapter 3.1.2.

4.2.1 Input Data and Procedure of Efficient Composition

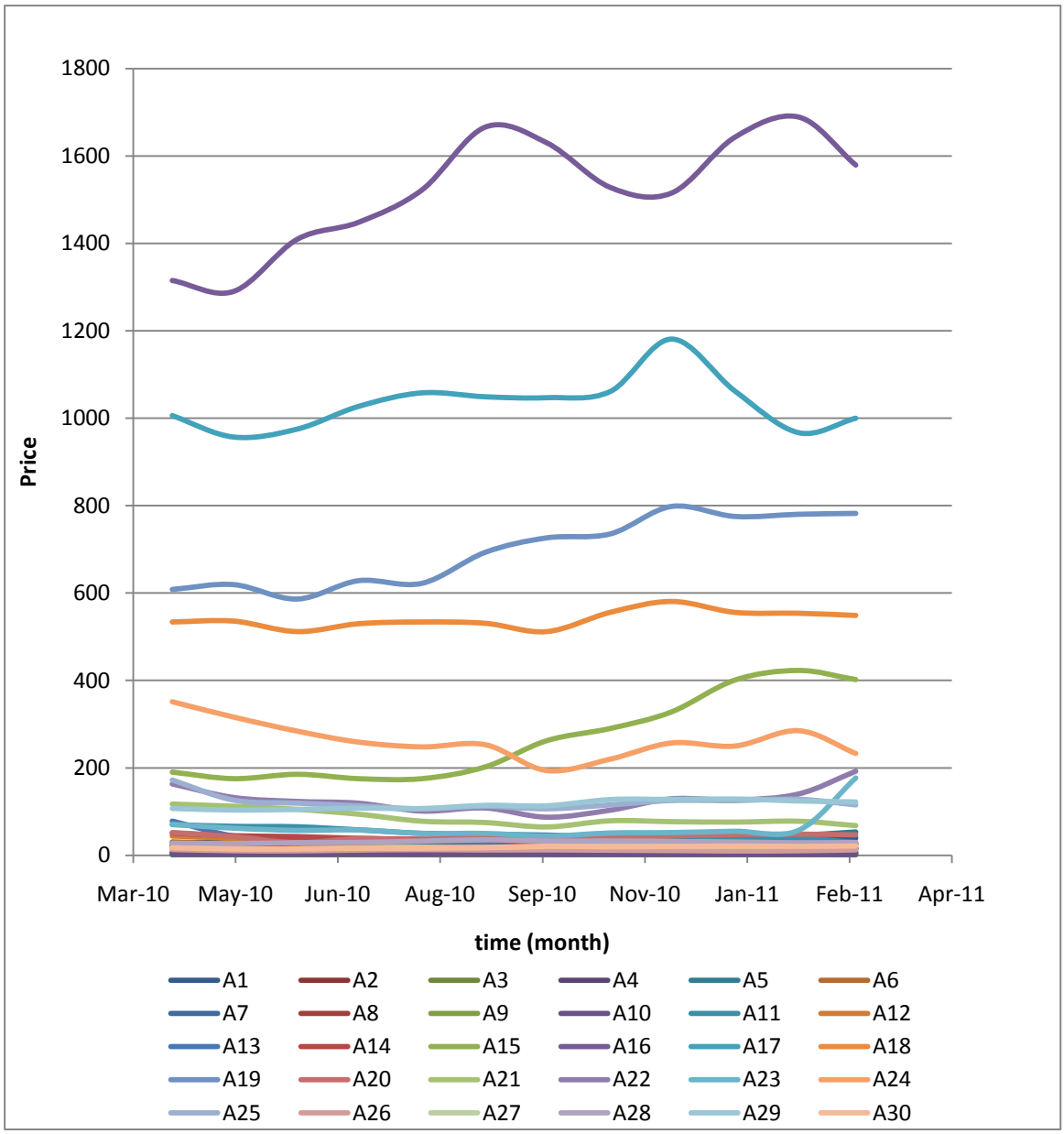
First step means to compute stock returns according to capital stock return (monthly). Input data of prices are in Table 4.4 and Chart 4.1, and calculated returns are in Table 4.3.

Table 4.4 Stocks – Prices

Assets	Months											
	Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10	Oct-10	Nov-10	Dec-10	Jan-11	Feb-11	Mar-11
A1	28,8	29,88	24,82	26,71	25,96	31,7	32,37	33,27	35,69	32,2	36,09	39,29
A2	23,06	21,21	18,8	22,4	20,67	21,54	24,85	17,95	20	18,28	18,11	16,97
A3	7,25	6,25	5,09	5,03	4,57	5,03	4,69	5	5,57	5,92	6,62	6,9
A4	6	5,34	4,64	4,53	4	3,9	4,09	3,87	5,03	4,83	5,72	6,6
A5	19,03	20,18	18,93	21,88	24,18	31,07	33,83	34,75	38,56	39,94	45,44	53,39
A6	30,54	25,8	23,01	25,81	23,47	24,49	26,67	25,26	27,91	27,73	26,58	25,82
A7	1,18	1,15	1,25	1,22	1,06	1	1,05	1,25	1,29	1,48	1,62	2
A8	18,1	21,08	19,06	16,39	15,63	19,8	18,84	17,91	20,11	23,22	20,59	24,58
A9	2,23	2,09	1,85	1,85	1,53	1,6	1,66	1,59	1,78	1,69	1,46	1,35
A10	2,65	2,26	2,26	2,28	1,81	2,1	1,84	1,86	1,62	1,83	1,51	1,6

A11	70	66	65	58	50	48	46	42	45	40	39	29
A12	44	38	27	30	29	30	30	28	29	21	23	27
A13	78	44	35	32	31	31	29	17	19	22	19	14
A14	51	45	43	39	37	37	22	17	13	15	13	16
A15	190	175	185	175	175	202	262	290	328	401	423	402
A16	1315	1290	1409	1448	1522	1666	1630	1528	1515	1643	1689	1579
A17	1006	957	975	1027	1058	1049	1047	1061	1181	1062	967	1000
A18	534	536	512	530	534	531	512	556	581	556	554	549
A19	608	619	586	628	622	693	726	735	798	775	780	782
A20	52,15	42,95	28,88	38,47	34,83	41,17	40,8	40	44,17	47,47	48,47	46,79
A21	117	112	105	94	78	75	65	79	77	76	78	68
A22	163	132	123	119	101	108	87	103	129	126	140	192
A23	71	62	57	58	50	50	44	51	52	55	57	177
A24	351	316	284	259	248	253	194	220	257	250	285	233
A25	172	126	119	113	106	112	106	115	125	125	128	115
A26	12,88	10,31	10,05	11,69	12,58	11,91	12,1	11,35	10,71	9,83	10,3	12,12
A27	18,76	16,2	14,91	17,28	18,5	17,59	20,38	24,2	21,83	20,08	22,03	23,06
A28	27,8	26,9	28,9	29,5	32,4	35,25	32,55	32,7	31,85	30,5	28,65	29,35
A29	107	103,3	104,7	107,6	106,8	114,1	113,1	127,3	127,6	128,6	124,1	121,8
A30	17,2	14,22	14,58	15,94	15,92	17,7	20,55	19,32	20,05	20,95	20,35	21,2

Chart 4.1 Stocks - Prices



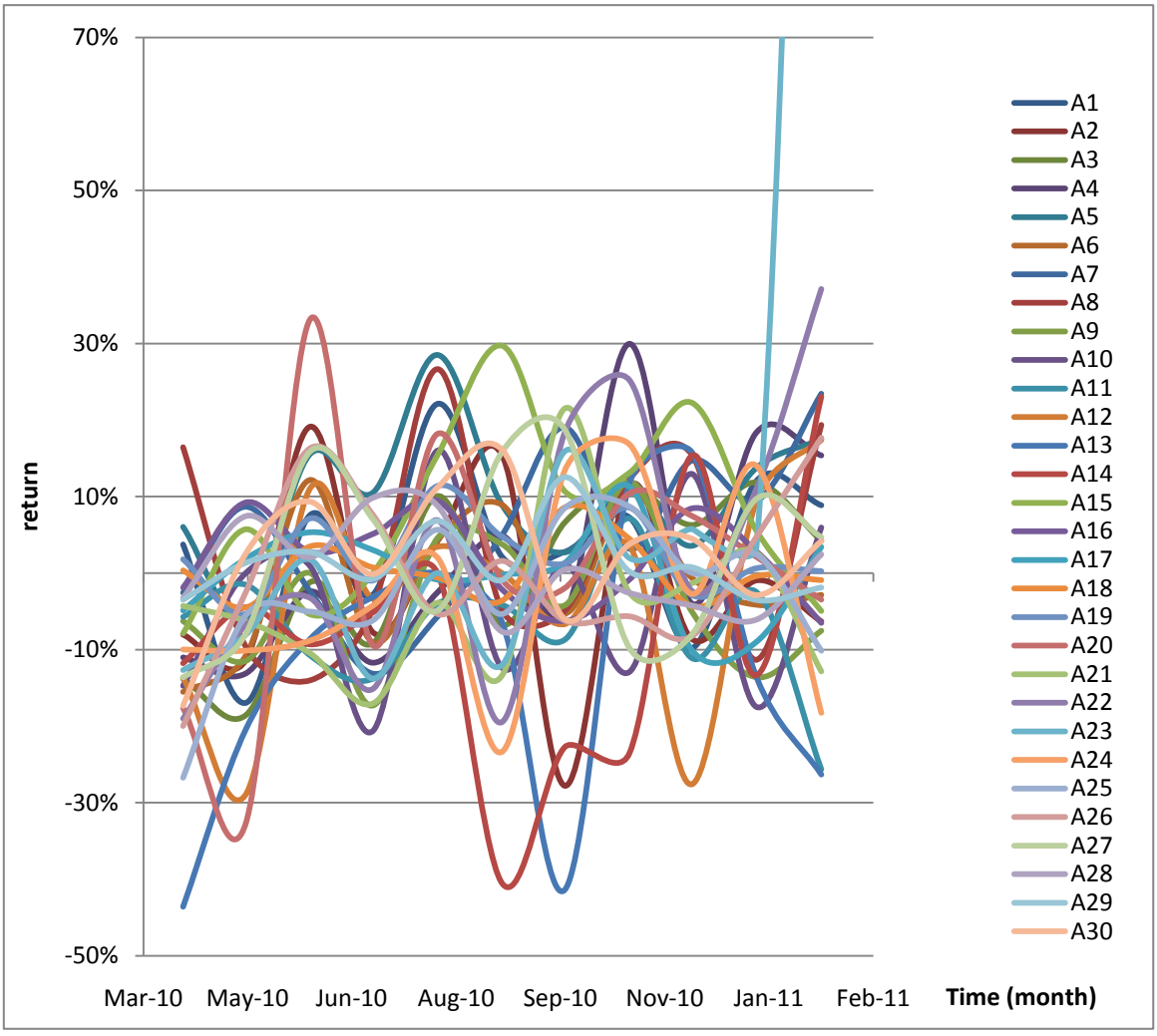
In the chart 4.1, there is a special change of asset A23, the firm of Nissei Build Kogyo Company Limited. The graph shows in the March of 2011 the prices of stock A23 have a big growth, the reason is earthquake. After earthquake reform, speculation that Fukuda will win rebuilding contracts has caused it to jump 92 percent on the Tokyo stock exchange since March 10, the last day of trading before the quake. That's the third-best performance among the 1,666 companies on the index, which has dropped 8.1 percent. Nissei Build Kogyo Co., a maker of prefabricated houses, leads gains having more than tripled since March 10. Osaka-based builder Fudo Tetra Corp. has more than doubled. Construction- related

companies account for 39 of the 40 best-performing topix stocks in the period. Reconstruction and relief efforts in the disaster area have been hampered by snow, damaged roads and fuel shortages. The devastation also covered a greater area than the 1995 Kobe quake and included many smaller towns with few transportation links.

Table 4.5 Stocks – Returns

Assets	Months										
	Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10	Oct-10	Nov-10	Dec-10	Jan-11	Feb-11
A1	3,75%	-16,93%	7,61%	-2,81%	22,11%	2,11%	2,78%	7,27%	-9,78%	12,08%	8,87%
A2	-8,02%	-11,36%	19,15%	-7,72%	4,21%	15,37%	-27,77%	11,42%	-8,60%	-0,93%	-6,29%
A3	-13,79%	-18,56%	-1,18%	-9,15%	10,07%	-6,76%	6,61%	11,40%	6,28%	11,82%	4,23%
A4	-11,00%	-13,11%	-2,37%	-11,70%	-2,50%	4,87%	-5,38%	29,97%	-3,98%	18,43%	15,38%
A5	6,04%	-6,19%	15,58%	10,51%	28,49%	8,88%	2,72%	10,96%	3,58%	13,77%	17,50%
A6	-15,52%	-10,81%	12,17%	-9,07%	4,35%	8,90%	-5,29%	10,49%	-0,64%	-4,15%	-2,86%
A7	-2,54%	8,70%	-2,40%	-13,11%	-5,66%	5,00%	19,05%	3,20%	14,73%	9,46%	23,46%
A8	16,46%	-9,58%	-14,01%	-4,64%	26,68%	-4,85%	-4,94%	12,28%	15,46%	-11,33%	19,38%
A9	-6,28%	-11,48%	0,00%	-17,30%	4,58%	3,75%	-4,22%	11,95%	-5,06%	-13,61%	-7,53%
A10	-14,72%	0,00%	0,88%	-20,61%	16,02%	-12,38%	1,09%	-12,90%	12,96%	-17,49%	5,96%
A11	-5,71%	-1,52%	-10,77%	-13,79%	-4,00%	-4,17%	-8,70%	7,14%	-11,11%	-2,50%	-25,64%
A12	-13,64%	-28,95%	11,11%	-3,33%	3,45%	0,00%	-6,67%	3,57%	-27,59%	9,52%	17,39%
A13	-43,59%	-20,45%	-8,57%	-3,13%	0,00%	-6,45%	-41,38%	11,76%	15,79%	-13,64%	-26,32%
A14	-11,76%	-4,44%	-9,30%	-5,13%	0,00%	-40,54%	-22,73%	-23,53%	15,38%	-13,33%	23,08%
A15	-7,89%	5,71%	-5,41%	0,00%	15,43%	29,70%	10,69%	13,10%	22,26%	5,49%	-4,96%
A16	-1,90%	9,22%	2,77%	5,11%	9,46%	-2,16%	-6,26%	-0,85%	8,45%	2,80%	-6,51%
A17	-4,87%	1,88%	5,33%	3,02%	-0,85%	-0,19%	1,34%	11,31%	-10,08%	-8,95%	3,41%
A18	0,37%	-4,48%	3,52%	0,75%	-0,56%	-3,58%	8,59%	4,50%	-4,30%	-0,36%	-0,90%
A19	1,81%	-5,33%	7,17%	-0,96%	11,41%	4,76%	1,24%	8,57%	-2,88%	0,65%	0,26%
A20	-17,64%	-32,76%	33,21%	-9,46%	18,20%	-0,90%	-1,96%	10,43%	7,47%	2,11%	-3,47%
A21	-4,27%	-6,25%	-10,48%	-17,02%	-3,85%	-13,33%	21,54%	-2,53%	-1,30%	2,63%	-12,82%
A22	-19,02%	-6,82%	-3,25%	-15,13%	6,93%	-19,44%	18,39%	25,24%	-2,33%	11,11%	37,14%
A23	-12,68%	-8,06%	1,75%	-13,79%	0,00%	-12,00%	15,91%	1,96%	5,77%	3,64%	210,53%
A24	-9,97%	-10,13%	-8,80%	-4,25%	2,02%	-23,32%	13,40%	16,82%	-2,72%	14,00%	-18,25%
A25	-26,74%	-5,56%	-5,04%	-6,19%	5,66%	-5,36%	8,49%	8,70%	0,00%	2,40%	-10,16%
A26	-19,95%	-2,52%	16,32%	7,61%	-5,33%	1,60%	-6,20%	-5,64%	-8,22%	4,78%	17,67%
A27	-13,65%	-7,96%	15,90%	7,06%	-4,92%	15,86%	18,74%	-9,79%	-8,02%	9,71%	4,68%
A28	-3,24%	7,43%	2,08%	9,83%	8,80%	-7,66%	0,46%	-2,60%	-4,24%	-6,07%	2,44%
A29	-3,46%	1,36%	2,77%	-0,74%	6,84%	-0,88%	12,56%	0,24%	0,78%	-3,50%	-1,85%
A30	-17,33%	2,53%	9,33%	-0,13%	11,18%	16,10%	-5,99%	3,78%	4,49%	-2,86%	4,18%

Chart 4.2 Stocks – Returns



Return on stock is shareholder total return equal capital gains plus dividends. The market frequently forgets the important relationship between return on capital and return on stock. A company can earn a high return on capital but shareholders could still suffer if the market price of the stock decreases over the same period. Similarly, a terrible company with a low return on capital may see its stock price increase if the firm performed less terribly than the market had expected. Or maybe the company is currently losing lots of money, but investors have bid up its stock in anticipation of future profits.

In other words, in the short term, there can be disconnect between how a company performs and how its stock performs. This is because a stock's market price is a function of the market's perception of the value of the future profits a company can create. Sometimes this perception is spot on; sometimes it is way off the mark. But over a longer period of time,

the market tends to get it right, and the performance of a company's stock will mirror the performance of the underlying business.

The covariance of the population file is determined according to covariance between returns with the function COVAR ($\vec{R}_i; \vec{R}_j$). Then it is apply the special model, tools→data analysis→covariance, that get the covariance matrix.

There is in the Table 4.6 covariance matrix C

Table 4.6 Covariance matrix C

Covariance Matrix C																														
	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18	A19	A20	A21	A22	A23	A24	A25	A26	A27	A28	A29	A30
A1	0.011	0.006	0.007	0.007	0.009	0.004	-0.002	0.005	0.004	0.001	0.000	0.013	0.000	-0.001	-0.001	-0.001	0.001	0.002	0.004	0.012	0.001	0.008	0.019	0.004	0.002	0.002	0.002	0.000	0.001	0.001
A2	0.006	0.018	0.001	0.007	0.006	0.009	-0.007	0.000	0.006	-0.003	0.003	0.009	0.012	-0.007	0.002	0.001	0.002	-0.001	0.004	0.013	-0.008	-0.005	-0.020	-0.005	-0.001	0.004	0.000	-0.002	-0.003	0.006
A3	0.007	0.018	0.009	0.008	0.005	0.003	0.002	0.007	0.003	0.002	0.001	0.006	0.003	0.002	0.001	-0.001	-0.001	0.002	0.002	0.010	0.005	0.011	0.014	0.008	0.004	-0.002	-0.001	-0.002	0.001	-0.001
A4	0.007	0.001	0.008	0.018	0.004	0.005	0.004	0.005	0.005	-0.005	0.003	0.011	0.004	-0.004	0.000	-0.004	0.002	0.001	0.003	0.006	0.000	0.015	0.041	0.006	0.002	0.001	-0.002	-0.004	-0.002	0.000
A5	0.009	0.007	0.005	0.004	0.008	0.003	-0.003	0.006	0.002	0.002	-0.001	0.010	0.003	0.003	-0.001	0.000	0.000	0.000	0.003	0.010	-0.002	0.004	0.022	0.000	0.001	0.003	0.001	0.001	0.000	0.002
A6	0.004	0.006	0.003	0.005	0.003	0.006	-0.002	0.002	0.006	0.001	0.002	0.005	0.006	-0.005	0.002	-0.001	0.002	0.001	0.003	0.010	-0.001	0.000	-0.009	0.000	0.001	0.001	0.001	-0.002	0.000	0.003
A7	-0.002	0.009	0.002	0.004	-0.003	-0.002	0.012	0.002	-0.001	0.004	-0.003	-0.001	-0.008	0.005	0.001	-0.003	-0.002	0.000	-0.002	-0.004	0.005	0.011	0.059	0.000	0.000	0.000	0.001	-0.003	0.000	-0.002
A8	0.005	-0.007	0.007	0.005	0.006	0.002	0.002	0.019	0.005	0.010	-0.002	0.002	0.008	0.012	0.004	0.001	0.000	-0.001	0.002	0.005	-0.001	0.011	0.054	0.000	0.002	-0.003	-0.008	0.001	0.001	0.002
A9	0.004	0.000	0.003	0.005	0.002	0.006	-0.001	0.005	0.007	0.002	0.003	0.003	0.005	-0.006	0.004	-0.001	0.002	0.001	0.003	0.008	0.001	0.003	-0.010	0.001	0.003	-0.002	-0.002	-0.002	0.001	0.003
A10	0.001	0.006	0.002	-0.005	0.002	0.001	0.004	0.010	0.002	0.014	-0.003	-0.004	0.000	0.012	0.001	0.002	-0.002	-0.001	0.001	0.005	0.002	0.005	0.031	-0.002	0.001	-0.002	-0.004	0.002	0.003	0.002
A11	0.000	-0.003	0.001	0.003	-0.001	0.002	-0.003	-0.002	0.003	-0.003	0.007	-0.003	0.005	-0.010	0.004	0.001	0.001	0.000	0.001	0.000	0.002	-0.002	-0.056	0.006	0.003	-0.005	-0.003	-0.001	0.000	0.000
A12	0.013	0.003	0.006	0.011	0.010	0.005	-0.001	0.002	0.003	-0.004	-0.003	0.021	-0.004	-0.002	-0.006	-0.005	0.003	0.002	0.004	0.013	-0.003	0.011	0.061	0.000	0.000	0.009	0.007	-0.001	-0.001	0.001
A13	0.000	0.009	0.003	0.004	0.003	0.006	-0.008	0.008	0.005	0.000	0.005	-0.004	0.027	0.002	0.007	0.005	-0.001	-0.002	0.002	0.010	-0.007	-0.008	-0.057	0.001	0.001	-0.004	-0.010	-0.002	-0.003	0.005
A14	-0.001	0.012	0.002	-0.004	0.003	-0.005	0.005	0.012	-0.006	0.012	-0.010	-0.002	0.002	0.031	-0.008	0.003	-0.003	-0.002	-0.003	-0.001	-0.004	0.010	0.098	-0.004	-0.004	0.004	-0.008	0.004	-0.001	-0.002
A15	-0.001	-0.007	0.001	0.000	-0.001	0.002	0.001	0.004	0.004	0.001	0.004	-0.006	0.007	-0.008	0.012	0.001	-0.002	-0.001	0.001	0.000	0.002	-0.006	-0.044	0.000	0.003	-0.007	-0.002	-0.003	0.001	0.003
A16	-0.001	0.002	-0.001	-0.004	0.000	-0.001	-0.003	0.001	-0.001	0.002	0.001	-0.005	0.005	0.003	0.001	0.003	-0.001	-0.001	0.000	0.000	-0.001	-0.005	-0.029	0.000	0.000	-0.002	-0.003	0.001	0.000	0.001
A17	0.001	0.001	-0.001	0.002	0.000	0.002	-0.002	0.000	0.002	-0.002	0.001	0.003	-0.001	-0.003	-0.002	-0.001	0.004	0.001	0.001	0.001	-0.001	0.003	0.008	0.000	0.000	0.001	0.000	0.001	0.000	0.000
A18	0.002	0.002	0.002	0.001	0.000	0.001	0.000	-0.001	0.001	-0.001	0.000	0.002	-0.002	-0.002	-0.001	-0.001	0.001	0.002	0.001	0.002	0.002	0.003	-0.002	0.003	0.001	0.000	0.002	0.000	0.001	-0.001
A19	0.004	-0.001	0.002	0.003	0.003	0.003	-0.002	0.002	0.003	0.001	0.001	0.004	0.002	-0.003	0.001	0.000	0.001	0.001	0.003	0.006	0.000	0.001	-0.006	0.001	0.001	0.000	0.000	0.000	0.001	0.002
A20	0.012	0.004	0.010	0.006	0.010	0.010	-0.004	0.005	0.008	0.005	0.000	0.013	0.010	-0.001	0.000	0.000	0.001	0.002	0.006	0.027	0.000	0.004	-0.013	0.004	0.003	0.002	0.003	-0.002	0.001	0.004
A21	0.001	0.013	0.005	0.000	-0.002	-0.001	0.005	-0.001	0.001	0.002	0.002	-0.003	-0.007	-0.004	0.002	-0.001	-0.001	0.002	0.000	0.000	0.011	0.007	-0.019	0.010	0.005	-0.005	0.002	-0.001	0.003	-0.004
A22	0.008	-0.008	0.011	0.015	0.004	0.000	0.011	0.011	0.003	0.005	-0.002	0.011	-0.008	0.010	-0.006	-0.005	0.003	0.003	0.001	0.004	0.007	0.029	0.108	0.009	0.004	0.001	-0.003	-0.001	0.001	-0.004
A23	0.019	-0.005	0.014	0.041	0.022	-0.009	0.059	0.054	-0.010	0.031	-0.056	0.061	-0.057	0.098	-0.044	-0.029	0.008	-0.002	-0.006	-0.013	-0.019	0.108	0.878	-0.043	-0.026	0.047	0.003	0.003	-0.009	-0.003
A24	0.004	-0.020	0.008	0.006	0.000	0.000	0.000	0.000	0.001	-0.002	0.006	0.000	0.001	-0.004	0.000	0.000	0.000	0.003	0.001	0.004	0.010	0.009	-0.043	0.017	0.007	-0.006	-0.002	-0.001	0.002	-0.005
A25	0.002	-0.005	0.004	0.002	0.001	0.001	0.000	0.002	0.003	0.001	0.003	0.000	0.001	-0.004	0.003	0.000	0.000	0.001	0.001	0.003	0.005	0.004	-0.026	0.007	0.004	-0.004	-0.001	-0.001	0.002	-0.001
A26	0.002	-0.001	-0.002	0.001	0.003	0.001	0.000	-0.003	-0.002	-0.002	-0.005	0.009	-0.004	0.004	-0.007	-0.002	0.001	0.000	0.000	0.002	-0.005	0.001	0.047	-0.006	-0.004	0.008	0.004	0.001	-0.002	0.001
A27	0.002	0.004	-0.001	-0.002	0.001	0.001	0.001	-0.008	-0.002	-0.004	-0.003	0.007	-0.010	-0.008	-0.002	-0.003	0.000	0.002	0.000	0.003	0.002	-0.003	0.003	-0.002	-0.001	0.004	0.011	-0.001	0.001	0.000
A28	0.000	0.000	-0.002	-0.004	0.001	-0.002	-0.003	0.001	-0.002	0.002	-0.001	-0.001	-0.002	0.004	-0.003	0.001	0.001	0.000	0.000	-0.002	-0.001	-0.001	0.003	-0.001	-0.001	0.001	-0.001	0.003	0.001	0.000
A29	0.001	-0.002	0.001	-0.002	0.000	0.000	0.000	0.001	0.001	0.003	0.000	-0.001	-0.003	-0.001	0.001	0.000	0.000	0.001	0.001	0.001	0.003	0.001	-0.009	0.002	0.002	-0.002	0.001	0.001	0.002	-0.001
A30	0.001	-0.003	-0.001	0.000	0.002	0.003	-0.002	0.002	0.003	0.002	0.000	0.001	0.005	-0.002	0.003	0.001	0.000	-0.001	0.002	0.004	-0.004	-0.004	-0.003	-0.005	-0.001	0.001	0.000	0.000	-0.001	0.004

The second step is set up the vector of variables for all problems and efficient portfolios (A to H), calculate variances, standard deviations and mean values of returns.

An efficient portfolio is one that lies on the efficient. An efficient portfolio provides the lowest level of risk possible for a given level of expected return. If a portfolio is efficient, then it is not possible to construct a portfolio with the same, or a better level, of expected return and a lower volatility. An efficient portfolio also provides the best returns achievable for a given level of risk. If a portfolio is efficient it is not possible to construct a portfolio with a higher expected return and the same or a lower level of volatility with the securities available

in the market, excluding risk free assets. Adding the latter allows one to construct portfolios that lie on the securities. The market portfolio is an efficient portfolio, and its risk and returns are those of the point where the securities market line touches the efficient frontier. There is in the Table 4.7 expected returns and standard deviation of assets.

Table 4.7 Expected Returns and Standard Deviation of assets

Assets	Expected Return	St.Dev.
Williams Sonoma Inc	3,37%	10,56%
STR Holdings Inc New	-1,87%	13,61%
Energy Solustions Inc	0,09%	10,67%
Heckmann Corp	1,69%	13,98%
Verifone Systems Inc	10,17%	9,04%
Microsoft Corp	-1,13%	9,14%
Intelligent Systems Corp	5,44%	11,05%
Imax Laboratories Inc	3,72%	14,43%
Alpha Pro Tech Ltd	-4,11%	8,65%
Sunlink Health Systems Inc	-3,74%	12,55%
DTZ Hldgs PLC	-7,34%	8,34%
International Ferro Metals Ltd	-3,19%	15,07%
Southern Cross Healthcare Group PLC	-12,36%	19,34%
Helphire Group PLC	-8,39%	17,77%
Exillon Energy Plc	7,65%	11,99%
Admiral Group Public Limited Company	1,83%	5,84%
Associated British Foods PLC	0,12%	6,23%
Compass Group PLC	0,32%	3,98%
Experian PLC	2,43%	5,06%
BP PLC	0,47%	17,58%
TOKYO KIKAI SEISAKUSHO LTD	-4,33%	10,42%
KANEMATSU-NNK CORP	2,98%	18,60%
Nissei Build Kogyo Company Limited	17,55%	64,65%
Pixela Corp	-2,84%	13,25%
TOKYO KEIKI INC	-3,07%	10,12%
Aeolus Tyre Co Ltd	0,01%	11,10%
Beijing Aritime Intelligent Control Co Ltd	2,51%	11,77%
China Resources Enterprise Ltd	0,66%	6,05%
Hang Seng Bank Ltd	1,28%	4,75%
Citic Pacific Ltd	2,30%	9,03%

4.2.2 Calculation procedure and results

The calculation of the efficient set is in coincidence of the chapter 3.4. Further, selection of the efficient portfolio A with minimum risk, as stated by the problem A. The optimal composition of the portfolio A is found by the solver model as a problem of nonlinear programming.

Procedure

(1) The portfolio A is calculated due to the Problem A, Table 3.1;

(2) The portfolio B is calculated due to the Problem B, Table 3.2;

(3) The portfolios C to H are calculated due to the Problem C to H, Table 3.3.

(4) Next, select the efficient portfolio B with the maximal expected return. The formulation of this nonlinear problem is to use the solver.

For calculating the equidistant interval for mean portfolio returns, ————————, the following step is to calculate generate equidistant points $E(R_{pj})$ for internal points of the efficient frontier of portfolios C to H.

.

It is successive to selecting of the efficient portfolios by means of use the solver as specified by problems C to H.

A solver is a generic term indicating a piece of mathematical software, possibly in the form of a stand-alone computer program or as a software library that 'solves' a mathematical problem. A solver takes problem descriptions in some sort of generic form and calculates their solution. In a solver, the emphasis is on creating a program or library that can easily be applied to other problems of similar type.

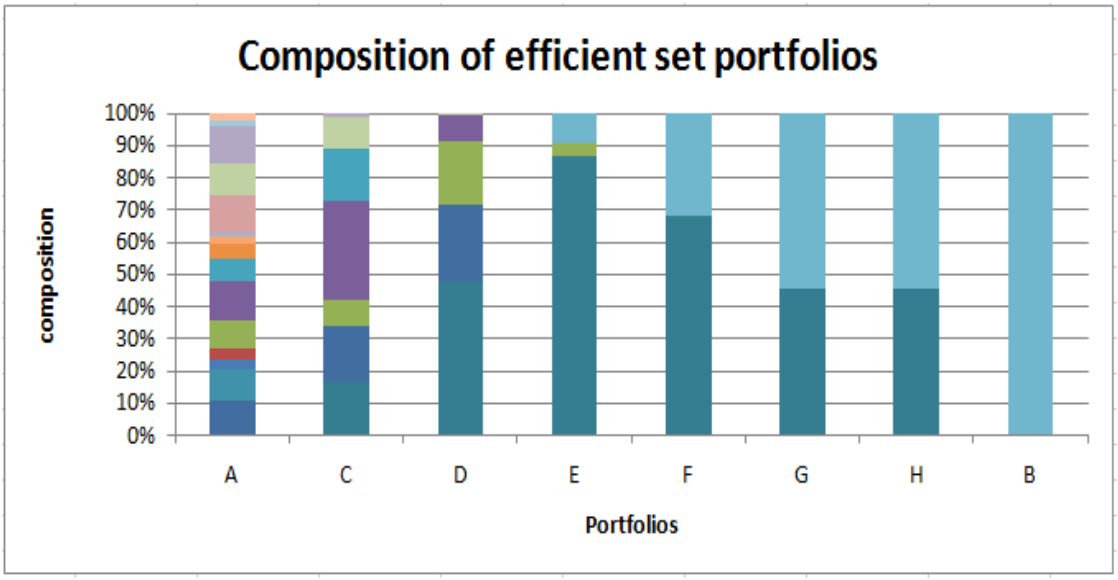
There are in the Table 4.8, Chart 4.3 results of calculation and portfolio composition of efficient set.

Table 4.8 Vectors of Variables X

Vector of variables x								
	A	C	D	E	F	G	H	B
XA1	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
XA2	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
XA3	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
XA4	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
XA5	0,00%	16,52%	48,19%	86,57%	68,42%	45,61%	45,61%	0,00%
XA6	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
XA7	10,68%	17,35%	23,28%	0,00%	0,00%	0,00%	0,00%	0,00%
XA8	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
XA9	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
XA10	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
XA11	9,82%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
XA12	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
XA13	3,31%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
XA14	3,39%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
XA15	8,42%	8,46%	20,03%	4,03%	0,00%	0,00%	0,00%	0,00%
XA16	12,10%	30,60%	8,03%	0,00%	0,00%	0,00%	0,00%	0,00%
XA17	7,26%	16,27%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
XA18	4,57%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
XA19	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
XA20	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
XA21	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
XA22	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
XA23	0,00%	0,00%	0,00%	9,40%	31,58%	54,39%	54,39%	100,00%
XA24	2,50%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
XA25	1,07%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
XA26	11,58%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
XA27	9,64%	9,67%	0,46%	0,00%	0,00%	0,00%	0,00%	0,00%
XA28	11,51%	1,11%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
XA29	1,86%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
XA30	2,28%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
Sum Xi	100,00%	100,00%	100,00%	100,00%	100,00%	100,00%	100,00%	100,00%

E(Rp)gen	0,35%	2,80%	5,26%	7,72%	10,18%	12,63%	12,63%	17,55%
E(Rp)calc	0,35%	4,10%	7,86%	10,76%	12,50%	14,18%	14,18%	17,55%
Variance	0,00207%	0,02%	0,19%	1,27%	5,38%	13,31%	13,31%	40,80%
St.Dev.	0,45%	1,30%	4,36%	11,26%	23,19%	36,48%	36,48	63,87%

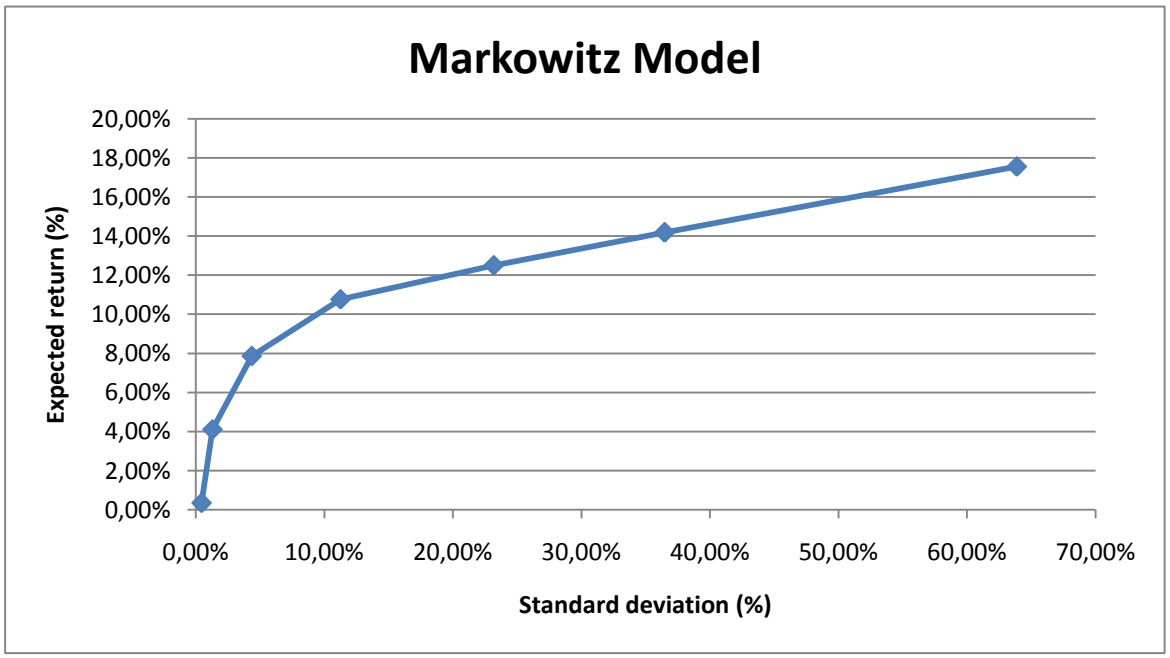
Chart 4.3 Composition of Efficient set portfolios



The graphical presentation indicates that if an investor has some idea about the expected return or risk, the composition of the efficient portfolio, including its expected characteristics, can be computed like chart 4.3 the portfolio C to H.

There are in the Chart 4.4 the results of Markowitz model efficient set.

Chart 4.4 Markowitz Model efficient set



Preference by investors to the rules, it can get a combination of portfolio border, while the use of investor indifference curve, it can reflect the preferences of investors, and the optimal portfolio is the efficient frontier and the indifference curve combination derived.

Construction is to choose the portfolio into the portfolio of securities and determine the appropriate weights, namely, the share of the investment securities portfolio proportions. Markowitz model shows that a reasonable goal of building a portfolio should be in a given level of risk with the highest rate of return on the formation of a portfolio. Portfolios with feature is called the efficient portfolio, it has been widely accepted as a model for optimal portfolio construction.

The purpose of the portfolio is according to investor demand, choose a variety of security of securities and other assets in the portfolio and then manage the portfolio to achieve investment objectives. Often based on investor demand risk (Risk) to define, and portfolio manager of the task some risks in the conditions, so that *ROI* (return) to maximize. Characteristics of asset allocation are to mix all major asset classes in order to lowest-risk conditions, the maximum long-term investment returns. Portfolio managers to long-term investment objectives as the starting point for improving the rate of return is often size up the situation to change the weights of the major asset classes.

Under given assumptions, the investors with the maximal risk aversion should choose the efficient portfolio A with the expected return of 0.35%. Since the covariance between stock return is lower than one, the minimum risk portfolio involves not only the stock with the lowest risk but also the others. By contrast, investors with the minimal risk aversion should invest into the portfolio B with the expected return of 17.55% and the risk level of 63.87%. It should get the highest return.

5. CONCLUSION

The objective of this diploma thesis is to find the optimal composition of the portfolio containing equity only. For solution of this problem CAMP model and Markowitz model was applied. There were 30 firms analyzed for inclusion into the portfolio; on the basis of the results of their characteristics, optimal composition for investor was proposed.

The diploma thesis was divided into four main chapters.

In the chapter 2, there is investment decision-making of financial institution described. It has been explained the theory of investment, financial markets and financial institutions. Investment is the commitment of funds by buying securities or other monetary or financial assets in the money markets or capital markets, or in fairly liquid real assets, such as gold or collectibles. There is Chart 2.1 about three effective market relations. Valuation is the method for assessing whether a potential investment is worth its price. Returns on investments will follow the risk-return spectrum. Chapter 3.2 describes approaches to equity valuation. Types of financial investments include shares, other equity investment, and bonds. These financial assets are then expected to provide income or positive future cash flows, and may increase or decrease in value yielding the investor capital gains or losses.

In the chapter 3, there is methodology of models of portfolio choice described. In this chapter the models of portfolio, especially the CAPM model and Markowitz model were explained. Financial modeling is the construction and using of planning and decision models based on financial data to simulate actual circumstances in order to facilitate decision making within an organization. The CAPM model describes the relationship between risk and expected return, and it serves as a model for the pricing of risky securities. Chapter 3.1 describes the efficient set composition. CAPM says that the expected return of a security or a portfolio equals to the rate on a risk-free security plus a risk premium. If this expected return does not meet or beat required return, the investment should not be undertaken. It is important to remember that high-beta shares usually give the highest returns. The optimal portfolio assumes that investors fanatically try to minimize risk while striving for the highest return possible. The theory states that investors will act rationally, always making decisions

aimed at maximizing their return for their acceptable level of risk. The Markowitz model assumes that the rational investors are averse to taking increased risk unless they are compensated by an adequate increase in expected return. The theory also assumes that for any given expected return, most rational investors will prefer a lower level of risk and for any given level of risk investors will prefer a higher return than a lower return. A set of efficient portfolios can be calculated from which the investor will choose the one most appropriate for their risk profile. The practical conclusions of the theory are that investors should diversify widely and determine their levels of risk by lending a proportion of their assets or borrowing to buy more risky assets.

Chapter 4 is the practical part of the diploma thesis and concentrates on optimal equity portfolio composition. From the international financial market, 30 stocks from the US, the UK, Japan and China (include Hong Kong) were selected for possible inclusion into portfolio. In Table 4.1 there are risk premiums and risk free rates for foreign countries, in Table 4.2 are fundamental characteristics of the securities of companies, which were analyzed. By applying the CAPM model, expected returns were calculated and are summarized in the Table 4.3. In the Table 4.8 are the vectors of variables X, which depicts the structure of the optimal portfolio, expected returns and standard deviation. In Chart 4.3 is graphically presented the relative composition of efficient set portfolios and in Chart 4.4 is Markowitz efficient portfolio set. The optimal portfolio is selected from the efficient portfolios.

Next step of analysis can focus on application of Black's model, Tobin Model, combination of efficient sets, and application of Value at Risk methodology for portfolio of stocks, change in the time, the assets to get the optimal composition efficient set.

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List of Abbreviations

APT	Arbitrage Pricing Theory
CAPM	Capital Asset Pricing Model
CML	Capital Market Line
CV	Coefficient of Variation
DDM	Dividend Discount Model
EPS	Earnings per Share
FT – SE 100	stock market index for the UK
GDP	Gross Domestic Product
NASDAQ	National Association of Securities Dealers Automated Quotations
NIKKEI 225	stock market index for the Tokyo Stock Exchange
OFCF	Operating Free Cash Flow
OTC	Over – The - Counter
P/BV	Price to Book Value ratio
P/CF	Price to Cash Flow ratio
P/E	Price to Earnings Ratio
P/S	Price to sales ratio
ROE	Return on Equity
ROI	Return on Investment
SML	Security Market Line
S&P 500	Free – Float Capital – Weighted Index for the US
WACC	Weighted Average Cost of Capital

List of Tables

List of Charts

Statement on the use of the results of the diploma thesis

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